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Agricultural Gazette of New South Wales.

Letters on the Diseases of Plants.

SECOND SERIES.

(Continued from p. 1072, November, 1903.)

N. A. COBB.

THE BROWN-ROT OF FRUIT.

THIS is a rot of fruit caused by the fungus *Monilia fructigena*—a rot most prevalent under moist conditions and confined to no particular kind of fruit, though it does most damage on cherries, peaches, and plums. It will attack a great variety of ripe and ripening fruit, and will even attack tender foliage under encouraging conditions.

The Brown-rot has come under notice in this State from time to time for a number of years, but it seems that it is only during our moist seasons, or in our moist districts, that it is to be feared. The disease appears with us to be quite as common on the cherry as on any other fruit, and the damage done is sometimes considerable, though I have never known of any such severe losses as have been reported in other countries,—where the destruction has sometimes reached enormous proportions. Cases are on record where the losses from this disease were variously estimated at from £50,000 to £100,000 in a single fruit-raising district, and very serious losses on a smaller scale have been of frequent occurrence. It appears that this fungus is one to be reckoned with seriously if it should become an established pest in our orchard districts. The portions of the State where it is most likely to do damage are those having an abundant rainfall during the spring and summer, and possessing the orchards necessary for its nourishment,—for we have no indigenous fruits upon which it is likely to flourish. Those parts of the State best adapted to cherry growing are the parts referred to.

The appearance of the fungus causing the Brown-rot of fruit should be well known to all observant fruit-growers. The softened fruit becomes covered with a grayish growth of spores, in some respects resembling the familiar green mould of bread, which is also frequently to be seen on fruit. The grayish growth just mentioned is made up largely of the spores of the fungus and it is these spores that are the principal means of spreading the fungus, which, so far as its injuriousness to fruit is concerned, has a simple history. The spores from one fruit are transferred to another and there set up the disease, which in the course of a few days' time has so far advanced as to be able to pass on to fresh victims.

In another part of these letters, reference has been made to the Ripe-rot, a rot that also attacks a great variety of fruits. In the case of Ripe-rot it is necessary for the fungus to have a way prepared for its entrance to the fruit. The Brown-rot is frequently aided in the same manner to gain an entrance to the fruit, but it is not entirely dependent on such obvious accidents. It is able to penetrate apparently sound fruit if the atmospheric conditions are of the right kind,—that is, if the air is continuously laden with moisture for a day or two and the temperature at the same time remains uniformly high, say at 80 to 90 degrees Fahrenheit. Under these conditions, apparently sound fruit may be attacked by this fungus with fearful rapidity, so that fruit in a ripening condition is swept off in a wholesale manner,—rotting on the tree or falling off. It not infrequently happens that the rotten fruit dries up and hangs on the tree, if undisturbed, for a long time. The appearance of the pulp of the fruit when in the grip of the disease is rather characteristic. The colour is a uniform brown, changing from a light shade to a darker with the progress of the disease. The diseased flesh has a watery appearance and a disagreeable look, though the taste is not very disagreeable. Advantage is sometimes taken of this latter fact to use up at canneries fruit that is in the first stages of the attack. The practice is not to be commended, as such fruit, though it may not be actually injurious to health, is certainly inferior in quality.

The injury to the foliage is of a more obscure nature, and is often overlooked, or mistaken in character and referred to some other cause. It is usual in this State for the orchardists sending in samples of fruit attacked by *Monilia* to say that the foliage is not attacked at all. As a matter of fact, I have never seen the characteristic spores of the disease growing on the foliage or branches of fruit trees, and I do not recall at the moment any record of this character in the writings of other observers; but there can be no doubt that the disease enters the bark of tender tissues in the vicinity of diseased fruit, and numerous instances of this are on record. There is nothing remarkable in this, as the same is known to be true of a number of other fungi attacking fruit and foliage of orchard trees. The fact is one of importance in its bearing on possible remedial measures. For this reason it is well, wherever this disease appears in the fruit, to give careful attention to the appearance of the foliage and new growths, both at the time of the attack on the fruit, and at later dates, in order to determine whether they have suffered from disease. If they have done so, the evidence will be found in the blighting of the twigs, the appearances not infrequently resembling "fire blight," or insect girdling.

Remedies.—The principal feature in the fight against this disease is the careful destruction of the diseased fruit; and where there are a number of orchards near each other, the same measures must be adopted in all, if much good is to follow. It is of little avail that one grower destroys his infected fruit, if his near neighbour, attacked in a similar manner, fails to do so. The spores of the disease are so abundant, and are so easily transported by various agencies, that neighbourly co-operation is very essential to good results.

The diseased fruit should not be allowed to accumulate on the ground, nor should the dried-up fruit on the trees be allowed to remain there. Either of these is liable to cause a continuance of the pest—in fact, there is at present, I believe, no other known source of infection, so that the problem is much simplified so far as concerns a knowledge of what ought to be done. The destruction of this infected fruit must be carried on systematically. Spasmodic efforts are not likely to be rewarded with a full measure of success. It should be borne in mind that this disease may exist on many different sorts of fruit, and though it does serious damage in this State to only a limited number of kinds, those other fruits upon which it finds but a bare subsistence may nevertheless be the means of its passing over from season to season.

The absolute destruction of the diseased fruit is what should be aimed at, although it must be admitted that this will sometimes involve considerable expense. Fruit attacked at or near maturity can be profitably fed tó pigs in some instances, but it should first be boiled. Burying should be deep if it is resorted to at all. Burning is to be recommended.

The application of chemicals to infested fruit has this disadvantage, that the chemicals seldom penetrate far enough to kill all the mycelium, and hence at a later date the uninjured mycelium may revive and again produce spores, even after it has lain dormant all winter.

From what I know of this fungus, I fully agree with all who have attempted to suggest remedial measures in the direction of fungicides applied to the fruit and foliage. There seems little hope that much can be done in this manner if the weather is favourable to the disease. The disease does comparatively little harm with us unless the weather is very warm and moist, and it is in such weather that treatment with fungicides is least successful. Everthing should be done that is economically possible to keep down the number of the spores of the disease, and of course it would be useless to deny that any treatment of the trees that reduced the number of the spores when they were few would be valuable if at a later date the weather conditions should become more favourable. Among the treatments that may be recommended on this score are various winter treatments, such as that with lime, sulphur, and salt. As this winter treatment has a value for many other purposes, its application to the present disease constitutes for it a further recommendation. The same may be said with considerable force with regard to all the different fungicides. If they are being applied for any other disease they will have some effect also on the Brown-rot. But too much weight must not be attached to these statements with regard to the use of fungicides for this disease, for, as before remarked, the disease is unlikely to do serious damage in this State unless the weather conditions are favourable to it; and it is precisely the weather conditions favourable to it that are most unfavourable to the usefulness of fungicides. It seems absolutely impossible to fight the disease with the aid of fungicides alone. The other main reliance must be care in the destruction of all diseased fruit.

I should be sorry if the foregoing remarks left the impression that the disease is found in our orchards *only* in wet seasons. That is not the case. It is to be found at all times, probably, but in limited quantity, a quantity safely to be neglected if it was the only disease in existence. If, however, the proper conditions arrive, it has a peculiar faculty of reviving with suddenness and destroying a large quantity of fruit. During and after such a season it is best to be specially careful, as there is greater probability than ever that spores of the disease will be left over to give the pest a fresh start the following year.

A Cherry Blight New to the State.

The cherries are attacked at blossoming time, and the effects become visible at that time or soon after. The young fruit, as soon as the petals have dropped, and while it has still the elongated form characteristic of

Fig. 123.—Two different blights of the cherry, one on the fruit and the other on the leaves. That on the fruit, due to a fungus variously classified, is shown at *a*, *b*, *c*, *d*. *a*, a fruit attacked at blossoming time and killed at an early stage of growth, the pedicel being also attacked and withered up: *b*, young fruit with its pedicel killed at a slightly later stage than *a*; *c*, fruit half grown attacked on one side and showing an outbreak of spores at the light-coloured areas on the darkened and shrunken flesh; *d*, half grown fruit attacked near the stem end and having its stem also attacked. The upper and largest cherry is free from the disease, and shows the stage to which all the fruits should have advanced but for the disease. The spots and holes on the leaves in the case illustrated are due to a second disease, although the fungus here shown on the fruit does sometimes attack the foliage. The microscopic characteristics of the fungus are shown in the next illustration.

the earliest stages, looses its normal green colour and becomes brown and shrivelled, sometimes almost black. In such cases the stem of the young fruit is also attacked, the indications being a brown colouration, and a shrivelling and drying up in a curled and distorted fashion. The fruits attacked at a little later stage also assume an unnatural colour, but they do not dry up so readily or so completely. They are more likely to present some portion of the surface where the disease is most intense, this portion being marked by a slightly darker colour at first and by a nearly black colour at last. If the fruit reaches the ripening stage, the ripening is characterised by unnatural colours.

Instead of a rich transparent creaminess, we behold a leprous appearance in the early stages, and when at last the reds and purples appear they are not pure and transparent but have a dullness somewhat like that of raw meat.

The actual outbreak of the spores of the fungus causing the trouble occurs on the darker areas just mentioned, and these outbreaks may occasionally be seen on even quite small and immature fruit; and I think it quite possible that they may occur on the stems of such young fruit, though I have not observed this. I have seen on the stems areas that had precisely the same appearances as those on the young fruit except that they bore no spores.

The naked eye characteristics of this disease are very well shown in Fig. 123, which is a life-size illustration of the disease as it appears on growing fruit of the cherry. The fungus shown in the same illustration as producing holes in the leaves is altogether different and has no connection with this disease of the fruit. On the smallest of the cherries shown, the disease has already completely destroyed the fruit, and it has become brown and shrivelled; the pedicel of the fruit has been also attacked and it has shrivelled and curved into the form of a letter S. The fruit *a* must have been attacked at the blossom stage. The fruit *b* was also attacked early, and the disease is seen on one side of the fruit near the top and on the stem. Similarly with the fruit *d*. At *c* a fruit is shown on which the fungus has produced spores in the manner described above, and this outbreak of spores is shown on some parts of the diseased area in the form of a whitish incrustation. The uppermost cherry has escaped the disease, and shows the stage to which all the fruits should have advanced if they had not been blighted. Attention is again called to the fact that the holes represented in the leaves are caused by a quite distinct disease.

Most of the damage is done before the cherries are half ripe, and the entire crop may be destroyed. The fruit that reaches a marketable size has a more or less unfavourable colour, and the flavour is decidedly flat if the fruit actually contains the fungus, as it may do, and yet reach a marketable size.

The dead fruit hangs on for some time, but finally drops off. The foilage does not appear to suffer much, but does to a certain extent suffer in the same manner as the stems of the young fruits.

The comparatively wet season of 1903 brought to light a considerable amount of this disease in some of the best cherry districts of the State—Tenterfield, Armidale, and Goulburn. A number of young orchards were badly attacked, and the losses must have totalled several hundred pounds.

At the time of the outbreak of the spores, which may be at any time after the fruit has set, though it seems to occur most frequently at the time the fruit is quarter grown, and from that time on, the spore-bearing areas become darker than the surrounding tissues and apparently more watery, as is indicated by an increased transparency in spite of the darker colour. The spores are collected on exceedingly short hyphæ, grouped in minute cushion-like clusters, which at first in some cases are snow white, but which later on become light brown.

The spore-clusters are quite distinct at first, but may run together after a short time, and the entire surface appear to be covered with an incrustation of spores if the air be dry, or with a somewhat gelatinous covering if the air be moist.

Fig. 124.—Stroma of the *Dematium*-like fungus causing the blight of cherries shown in Fig. 123. It will be seen that the hyphæ forming the stroma are for the most part without spores, this being due to the process of sectioning and mounting. At *a*, however, fresh spores are starting: *b*, hypha with five spores that have remained attached; *c*, tissue of the cherry that has become brown owing to the attack of the fungus: *d*, surface of the cherry. A newer or younger stroma than that shown may be sectioned so that a much larger proportion of the spores will remain attached to the hyphæ. Several of the escaped spores are shown above the stroma.

As to the spores themselves, the measurements of ten spores, taken at random, are given in the margin, and it will be seen that the average is 10·5 x 3·2 μ., the range being 2·5-20 x 1·5-5 μ. This range in the size of the spores is far greater than is usual among fungus species. When these spores are placed in water they have not, with me, so far, shown a tendency to sprout and form a mycelium. When placed in an infusion of cherries, however, I have noted that they bud copiously after the manner of yeast, and from this cause the number of spores increases, while their size decreases. The spores, when undergoing this process of budding, often show vacuoles, while the original spores, as obtained from the surface of cherries, were often without vacuoles and with very little internal differentiation.

7·5	x	3·7
19·	,,	5·
20·	,,	3·3
10·6	,,	4·5
11·8	,,	2·8
2·5	,,	1·5
8·7	,,	2·5
10·4	,,	2·8
8·3	,,	3·
6·5	,,	2·7
Av. 10·5	x	3·2

Sections across the areas where the snow-white cushion-shaped spore masses have been pushed forth, show slightly-raised beds from which the spores are produced. In the sections mounted in water these beds are destitute of spores, except of the very smallest size, all the others having been washed away. The hyphæ upon which the spores are borne are of a larger diameter than the spores themselves. On some occasions it is possible to see these small spores growing on the ends of the hyphæ of the stroma, and it is then apparent that the spores are borne in numbers on each hypha. In sections made from fresh material, while the hyphæ are 9-13 μ in diameter the spores are 1·5-5 μ in diameter. The spores are ellipsoidal or elongated in form, being very seldom of exactly the same form at the two ends. The broader hyphæ on which they are borne are several times as long as the spores themselves, and are unbranched and packed close together in the stroma, which is only slightly raised above the surface of the diseased area. All these appearances can be seen only with the aid of medium or high powers of the microscope. The smallest stroma seen was not more than four to five times as wide as the spore-bearing hyphæ—that is to say, measured 40 μ. The larger spore beds measure 180 μ and upwards. (See Fig. 124.)

The septate mycelium seen in the diseased cherries was colourless, and varied in diameter from 3 to 9 micromillimetres, one of its

striking characteristics being sudden changes from the minimum diameter to the maximum. None of the clamp joints, such as are

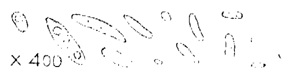


Fig. 125.—Spores of the fungus causing the blight figured in illustration No. 123. The spores vary greatly in size, some being hundreds of times larger than others. As the spores are born on the hyphæ of the stroma they do not differ so much in size, but by a process of budding they often increase much in number, at the same time diminishing much in size. The illustration attempts to show the range of size due to this budding process.

characteristic of the mycelium of the Basidiomycetes were seen. It will be observed that the mycelium gathers together to form a distinct stroma for the bearing of the spores. However, there were some of these spore-beds so small that they must have been composed of comparatively few hyphæ.

I have inoculated green hedge-plums, green nectarines, and ripe cherries, loquats, apples, and bananas, from cultures of the spores, but, so far, with negative results.

"Take-all,"—a Disease of Cereals.

Some years ago there appeared in the pages of this journal a report on the series of diseases usually treated of under the name of "Take-all." Since that time further observations have been made, and the results of these observations appear worthy of abstraction from the letters on the subject and arrangement in a connected form. The most important result is the discovery of what seems to be a reliable method of treatment.

It is plain that the disease is one connected with a moist condition of the soil. We have heard little of it during the drought, but during the present season, 1903—a moist season—numerous cases have been observed, and the losses have been considerable. The appearances are the same as those formerly reported, and the species of fungi are the same, giving rise, as before remarked, to the opinion that the term "Take-all" is one that must be understood to include a number of different diseases which further study may isolate and prove to be physiologically more or less related.

The disease, or the diseases, may be combated by the application of lime, used at the rate of not less than one ton to the acre.

I have seen cases of "Take-all" that were connected in the most manifest manner with certain slightly depressed areas where storm waters stood for some time in puddles and finally sank into the soil. If the storm occurred at a stage when the cereal growth was still soft and tender and therefore susceptible, the plants went off with typical "Take-all."

Of course, in the last analysis, all the foregoing points to lack of efficient drainage as one of the prime causes of these diseases, and anything that can be done to improve the drainage will be beneficial. Even an extra deep tillage of the right sort will do good, as it often happens that the damage is done in a short time by standing water, the damage being apparently due to the lack of air about the roots of the

plants, the same being excluded by the water. Such instances would be less common if the soil were rendered more porous by deep culture, the small improvement secured in this way being sufficient to permit the waters of small storms to sink in rapidly enough to allow the plants to escape "drowning." These slight depressions in the paddock may in some cases be gradually filled in by the right method of ploughing, which constantly turns the soil from their margins towards the centre of the depression. I have seen extensive areas subject to "Take-all" that could be dealt with in this manner and cured in the course of a few years, but of course such a combination of circumstances is not common.

Since dealing with the matter in 1893 I have found that the following treatment is almost invariably followed by good results. At a time when the disease is showing, which it always does in patches of greater or less extent, mark the patches with stakes, and after harvest and before the following ploughing apply lime, or wood ashes known to have a large proportion of lime, at the rate of at least one ton to the acre, better more. Of course only the diseased areas need be so treated.

This treatment is based on a general knowledge of the causes of the trouble and the fact that the disease continues from year to year in the same place. It is possible that if one year is very favourable to the disease and it is followed by a year that is very unfavourable to the disease the patch will not persist, but this is exceptional and does not upset the rule. If the season is very favourable to the disease or there is a succession of such seasons, the disease may appear so as to cover large areas. It appears that such was the case in 1903 in some districts.

While on the subject of "Take-all" it may be well to mention that Sorghum has been known to suffer from the attacks of *Cladosporium* in the same way as wheat and other cereals. The appearances of the cases examined by me are much the same as those formerly described in connection with wheat and oats. I have seen Sorghum dead and dying in patches with no other signs of parasitic growth than the abundant growth of *Cladosporium*, so that it seems a fair inference that this grass is also subject to "Take-all."

VARIOUS RUSTS

MORE interesting than destructive is the rust of the White Clover. Though not uncommon, it is never, so far as I have observed, so prevalent as to do very much damage. Not infrequently it happens to

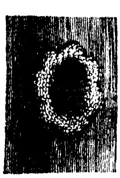


Fig. 126.—Aecidium of the rust of the common White Clover (*Trifolium repens*). Magnified 10 diameters.

Aecidio-spores.—The nearly colourless, closely verrucose, polygonal or rounded æcidio-spores measure 16 to 18 by 20 to 25 μ and are borne in cup-shaped pseudoperidia, having everted whitish dentate edges. The diseased spots are about two millimetres across.

attract the attention of some observant person, who, influenced by its general resemblance to other more destructive rusts, makes inquiry as

to whether it is not the same as wheat rust or some other dreaded rust. Fortunately this rust is not the same as wheat rust, however much it may to the ordinary observer appear to resemble it. Confined as it is in its attacks to the white clover, it does little harm. In other countries it attacks red clover, but I believe there is no record of such a case in this country.

It is unnecessary to enter upon any discussion of remedies, as the disease is of no serious consequence. It would not receive attention here but for the fact that it is sometimes forwarded by needlessly

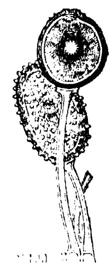


Fig. 127.—Uredo-spore and teleuto-spore of the rust-fungus of the Common White Clover.

Uredo-spores.—The scattered cinnamon brown sori bear roundish or ellipsoidal pale brown echinulate spores, measuring 25–35 x 15–18 μ, each possessed of two opposite equatorial germ pores.

Teleuto-spores.—The sori are darker than those of the uredo-spore stage and bear more nearly spherical smooth dark-brown spores of a diameter varying between 20 and 35 μ, and each having a large germ pore at the thickened apex, where there is often one or more papillæ.

alarmed correspondents. No uneasiness need be caused by the appearance of rust on white clover.

Oat Rust.

On one occasion my inquiries on this subject covered a considerable area devoted to dairying on the Tweed and Richmond Rivers, for the most part consisting of lands similar to that in the vicinity of the town of Alstonville. A score or more of paddocks in a dozen or more localities were examined both as to the amount of rust and the nature of the rust. I found that the paddocks in the vicinity of the settlements were, as a rule, more severely smitten with rust than paddocks elsewhere. Thus I found considerable rust in paddocks in the vicinity of Lismore, Murwillumbah and Alstonville. In general the amount of rust seen was not such as to cause surprise or even concern. As a rule I found the oat crops comparatively free from this disease. No doubt the larger amount to be seen in certain paddocks near the towns was accounted for by the continuous growth of oats in those paddocks or near by. Under such circumstances the disease is bound to accumulate. The continuous growth of any crop for a long series of years on the same land always has this result. Though at first the diseases of the crop may be light their intensity increases year by year. A little thought will show that this is only what must be expected, not only with crops of oats, but with any crop, or any class of stock. Thus the comparative freedom of new clearings from rust is in accordance with this law. It does not of course follow that a new paddock may not be severely smitten with rust. Such a thing may occur, but in the natural course of events this will be less common than a similar visitation on an old paddock that has borne oats for a succession of years. In the course of my inquiries I had my attention

called to the fact that the oats had spots of rust on the leaves as soon as the first two leaves had appeared. There is nothing uncommon in this. In seasons when rust is prevalent it often appears on the crops soon after they show above ground. The fact that this observation can be made in any particular season only shows that the season is one rather favourable to rust and that the disease is present ready to take advantage of the fact. It is very uncommon to see a crop of oats that is entirely free from rust in a climate such as that characteristic of our northern rivers.

Considering the severity of which this disease is capable I do not consider that there is much occasion for alarm, though it is beyond question wise to give close attention to the progress of the disease in various districts.

The amount of loss is what must govern any action taken. It is evident that oats are considered as one of the best of winter feeds in some districts and that anything that threatened this crop would at present be regarded as a serious danger. From what I saw I think we may without fear continue the growth of this crop for that purpose for some time to come, but I fear that the continuous growth of this crop year after year on the same land for a long time will compel us in the long run to abandon its growth, especially if meanwhile nothing is done to minimise the disease. In the course of this report I intend to suggest some lines of action that will enable dairymen, if they so desire, to continue the growth of this crop for winter feed. At the same time I would advise that attention should be given to some other sources of winter feed suitable for dairy cattle.

At a meeting held for the discussion of this question I had the honour to call attention in a pointed manner to the exact nature of the rust disease. I showed with the aid of the microscope that rust is a microscopic plant that propagates in a manner similar to that followed by oats, with this important difference that the "seeds," or spores of the rust are so minute that they can be easily carried on the wind for long distances. The number of the spores, as I showed,

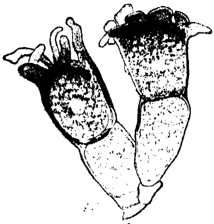


Fig. 128.—Teleutospores of the common Australian rust of the oat. These occur in linear, black, more or less confluent sori, that remain for a long time completely covered by the cuticle. As the figure shows, the brown cylindroid to conoid spores are borne on very short pedicels, measure 40-60 × 12-20μ, and are characterised by bearing at the truncate distal end 6-7 blunt irregularly finger-shaped processes.

The orange-yellow spheroidal to ellipsoidal faintly echinulate, uredospores are borne in very pulverulent, elongated, often confluent sori. Size, 15–20 × 20–28μ.

is so great as to be almost beyond calculation. The number of spores on a single leaf of rusty oats might reach millions. It is no wonder then that the disease is widespread, especially when we remember that it runs its course in a few days' time. Already the rust is so common in some districts that the spores are to be found almost universally distributed. I found them on the fences, high up in trees, and in the dust of the hotel rooms in all parts where the rust was particularly prevalent.

There is however nothing unusual in this. It is a common feature of this rust disease, and only shows how likely an outbreak of the disease is, once the conditions are favourable to it.

The rust found upon oat crops is one that is well known so far as I am able to say at present, in fact it would be remarkable if this were not so. I hope to examine specimens later in the season that will set at rest all doubts upon this head. From an examination of the uredospores the species appears to be *Puccinia coronata*.*

The conditions that favour the spread of the rust disease are warmth and moisture. As these factors vary from season to season it is easy to understand why the disease varies in intensity in different years. It is sometimes said that rust has "suddenly appeared" in a district. Such a statement is rarely true, the fact being that it has been all the time present. What is meant is that it has suddenly increased in intensity. This is due to favourable weather conditions. It is very necessary to bear this in mind in reasoning about the disease, otherwise there is danger of arriving at wrong conclusions.

The species of rust that attack the various cereal crops though similar to one another are not always the same. The tendency of recent research is toward the belief that each species of rust is very particular about its host plant, and that although two rusts may resemble each other very closely they are often found each to be associated with a single crop or a very limited number of related crops. From this it follows that we should be careful about confounding rusts found on various crops. The rust of wheat is a different rust for instance from that most common on oats. Yet if a crop of wheat were found growing alongside oats and both were found to be rusty it would be natural to think that both crops were suffering from the same disease, if we did not allow for the abovementioned fact. Nevertheless the chances are that the two crops would be suffering from different diseases derived from quite different sources, having no connection with each other. These facts are mentioned to put farmers on their guard in reasoning about the occurrence and prevalence of rust.

The principal interest centres in what can be done to minimise the losses due to the disease. What one will do depends entirely on how much he is losing and how much he fears he will lose. As before remarked, the amount of oat rust at present is not such as in my opinion to cause great alarm. But it is enough to justify making inquiries and experiments as to how the losses can be minimised. Those experiments could be most profitably carried out on private farms and at the Experiment Farms located in various districts. I would advise farmers to beware of experiments and opinions derived from districts other than their own, unless it is quite certain that such districts are similar in all respects to their own district.

The experiments that in my opinion would be advisable relate to trials of various varieties of oats, to the use of other sorts of winter feed, and to the trial of ensilage.

* This determination has since been confirmed.

Varieties of Oats.

It is a well-established fact that the various varieties of oats vary in their resistance to rust. The rank-growing varieties as a rule suffer most. Of course it may be that the varieties that are the most resistant are not the best for fodder. But analogy would lead to the conclusion that resistant sorts can be found that will be entirely suitable fodder for milking cows. As I said before, only experiments in various districts can determine what varieties are the best, and if such experiments have not been already made, it would be advisable, in my opinion, that they should be made without delay if this crop is to continue to be a main dependence for winter feed as at present. Such trials, however, will be useless unless, when completed, farmers can make sure of securing seed of the best varieties. It would therefore be best to so conduct any trials that the source of the seed is quite well-known and is such that the *seed can be reliably supplied from year to year.* This, of course, involves arrangements with some reliable seedsmen and growers. It ought to be possible to make such arrangements.

Other Fodder Crops.

There appears at present to be very little else than oats grown on the Northern Rivers for winter feed, doubtless because that crop has shown itself well adapted to local conditions. There is good reason, however, to doubt whether it will always continue to be as suitable as it is at present; in fact the present inquiry is a hint in that direction. The reason for this doubt has been already indicated, namely, the tendency when a single crop is grown continuously on the same land, for the diseases of that crop to accumulate until the crop is no longer profitable. It would be advisable, in my opinion, that steps should be taken to provide against the possible arrival of a time when oats will not do so well as they have in the past. The eggs are now all in one basket. A severe rusty season would do great injury under the present system.

Apart from this, it is well-known that the too exclusive use of one fodder may lead to poor results. A variety of fodder is the natural ration of most ruminants, and appears to be essential to high and continuous milk production. It is hardly necessary for me to specify what crops may be experimented upon. Sorghums, wheat and other cereals, millets, rape (though the latter may not be suitable for milking cows), and many other things could be tried with some hope of success.

Ensiiage appears to have been but little tried in the Northern River districts. I heard of three small lots, though I did not see a single stack or pit. I was assured, on good authority, that good ensilage had been prepared; and if there is no natural climatic reason why ensilage cannot be prepared and kept, it seems as if it should receive a fair trial, although it cannot be expected to be so profitable as in more severe climates where the growth of winter feeds is impossible.

Treatment of Seed Oats for Rust.

There is no reason to think that any treatment of seed oats will be beneficial in preventing rust. This question has arisen more than once. The question has been very carefully studied, and the best authorities agree that no treatment of the seed has ever been shown to be beneficial in preventing rust, though it is different with smut—another disease of oats.

Rusty Oats as Fodder.

Rusty oat plants, so long as they are still alive and fairly green, may be used as fodder with comparative impunity. The nutritive value of rusty oats is less than that of non-rusty oats, and that is about all that can be said. After the tissues are killed, as the result of rust, the fermenting dead and dying parts are unsuitable for fodder, and will not be chosen by stock if succulent food is at hand. Any doubt on this point may be inexpensively settled through a co-operative experiment by feeding a healthy animal upon rusty oats.

Sunflower Rust.

The Sunflower also suffers from the attacks of a rust. The disease is rather common in this State and the attacks are sometimes of a serious character, the yield of seed being much diminished. As, however, the crop is one of minor importance it has never been possible among the numerous calls of a more important character to give any detailed attention to this disease. The present paragraph is merely the outcome of the slight accumulation of data I find on hand as the result of semi-occasional specimens and inquiries.

The appearance of the disease, as manifested on the Sunflower is unmistakable, and needs little description. In all well-marked cases the leaves become covered with a rust-coloured powder composed entirely of the spores of the rust fungus. There is no other disease of the Sunflower that is at all likely to be confounded with it. The disease may occur on the stalks and parts of the flower, but the main attack is on the leaves. These soon loose their normal green colour and droop and die. In the worst cases the plant may die, though this is not often the case. The yield is much diminished, and the quality of the seed is reduced.

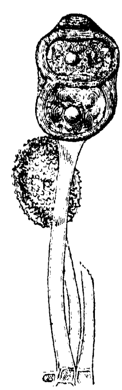


Fig. 129.—Spores of the rust of the Sunflower.

The disease also attacks the varieties cultivated for their flowers alone, and it is just as destructive to them as to other varieties.

The remedies that may be adopted are not such as have been sufficiently tested. They are derived from what is known to be true in other somewhat analogous instances. They are, (1) the application of Bordeaux Mixture, (2) the plucking of all infected leaves as soon as they appear to be a source of danger to the healthy parts of the plants, (3) thinning out the

plantation so as to admit plenty of sunlight, (4) good culture and the application of suitable manure as a top-dressing. The manure should not be of a highly nitrogenous nature.

With regard to the application of Bordeaux Mixture it may be said that it will certainly prevent the germination of all the spores with which it comes in contact, but it will be necessary to make the applications frequent if the result is to be beneficial, for the spores are produced in abundance and with rapidity, so that two days after an application there may be another crop of spores ready to produce further infection. The weaker form Bordeaux Mixture will not injure the Sunflower plants, and if the mixture be properly made an almost unlimited quantity of it may be applied. The suggestion is to apply the Mixture every two to three days, the best time of day being evening or early morning. * * * *

From time to time for a number of years inquiries have reached the writer, showing that more complete information on the various genera of Rust-fungi would be acceptable to a considerable number of readers of this *Gazette*. There is no Australian work dealing comprehensively with this subject. The insertion in these letters of copies of a number of classical illustrations from the works of Tulasne, de Bary and Plowright may do some little service in this direction. The originals are for the most part in comparatively inaccessible scientific publications. All the most important genera of the *Uredineæ*, or Rust-fungi, are illustrated and explained, the explanation of each plate being placed opposite. (See p. 18 and following.)

Smut of the Prairie Grass.

The season of 1903, following on a succession of droughty years, and being itself rather a moist season, gave rise to some unusual fungus developments. One of these was the appearance of smut on Prairie Grass. The species of smut found on this grass is already known in this State, though not previously seen on this species of grass. It is a species of smut reported from various parts of the world on grasses of the genus Bromus. It is not generally supposed to do much harm. It has appeared in one instance in this State as a marked attack on Prairie Grass self-sown on a paddock formerly remarkable for its crops of smutty maize, and the question arose whether the two had any connection. As the two smuts, that of maize and that of the Brome grasses, are different species, the occurrence in the same paddock in successive years, can be looked upon only in the light of a coincidence. It may well be that the particular paddock is one in which the conditions are very suitable for the growth of smut fungi. It may be safely assumed that the conditions, other than the host-plant condition, required by two smuts so like each other as the smuts of maize and Brome grass, would be similar, and no doubt if maize had been grown in 1903 in this paddock the smut proper to it would have made its appearance.

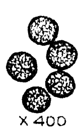


Fig. 130.—Spores of the smut of Prairie Grass, *Ustilago bromivora*, Tul.

When the Brome grass is attacked by this smut the inflorescence is completely filled with a sooty collection of spores. Such diseased

Fig. 131.—Spore of the smut of Prairie Grass more highly magnified than in the preceding illustration, showing the irregularities on the surface of the spore.

plants are unsuitable for fodder, though I do not know that they are actually poisonous, as they have sometimes been reported to be.

Disease in the Fruit of the Banana.

Two green half-grown bananas sent in by Mr. Martin, fruit inspector, from cargo received at Sydney, gave rise to the following notes:—

The fruits, two in number, appeared hollow and discoloured in cross-section. The pulp had partly disappeared, a "pipe" having appeared throughout the length of the fruit. The pulp around the pipe had taken on a brown or purplish brown or even a purple colour, the interior of the fruit having thus acquired quite a lurid appearance. The cross-section of the rind presented an unusually yellow and viscid appearance, reminding one somewhat of the appearance of recently cut gummy cane. In case of one of the two specimens sent, a hole, as of an insect, was discovered at the distal end of the fruit, but no insect was to be seen, nor were there any definite traces of an insect having occupied the cavity of the fruit.

Microscopic Appearances.—There was no trace of a fungus—no mycelium or spores. There were microbes in some parts, and the appearances gave rise to a suspicion that possibly there might be a definite disease present, due to this cause. The stems of both specimens were black, dry, dead and corroded. It is not impossible that the appearances were due to injuries to these parts of the fruit, but there was no evidence of a wrench or twist of any sort.

Tomato Rosette.

The following notes by a correspondent are of interest in connection with Tomato Rosette which has now apparently disappeared:—"In the April number of the *Gazette* appear particulars of a tomato disease—'Rosette.' I have about thirty vines growing here on virgin soil. Tomatoes have not been grown within miles of these vines, this being the heart of what was a sheep station. The seed was obtained from three sources, viz., Yates, Anderson's, and from fruit bought at a local fruit store, yet this disease has shown itself. At first only two vines were affected, but as the dry weather became more severe more vines fell victims to the disease, until more than half the vines are badly affected. Where a few vines were constantly watered no signs of the disease occurred. This led me to the conclusion that the disease is altogether due to the drought, as we did not receive in all an inch of rain from the end of November, to the end of March, and it was only by constant cultivation that the vines were kept alive."

Bark and Wood Diseases Spread by the Pruning Shears.

I am inclined to think that the method of pruning may have had much to do with the diseased condition of occasional specimens submitted to me. It not unfrequently happens that diseases of the bark and wood are unwittingly spread through pruning with infected shears or other tools. To give an illustration, suppose that at the first cut the shears pass through a pustule of some disease, such as is to be occasionally found on almost any tree, in connection with the dead or weakened branches that need cutting away. The shears thus become smeared with the spores of the disease, and at the next cut these spores are transferred to another part of the tree, where they may have a good chance to establish themselves so as to do much harm. The operation just described constitutes an almost ideal method of spreading the disease by inoculation, and there can be little doubt that in the case of certain diseases, especially of the bark, this is one of the most common methods by which the disease is spread. The obvious remedy is to disinfect the shear cuts, and this can be done by the application of any one of several substances, such as good white lead paint, whitewash, thick Bordeaux mixture, or even hot grafting wax.

Of course, after the disease has got a good hold at an old pruning mark it is not easy to eradicate it. The best way to proceed is to scrub or scrape down the trunk and larger branches so as to remove all the old bark possible. These scrapings should be burned. Afterwards apply the lime, sulphur and salt mixture, or thick Bordeaux mixture to the trunk and branches, preferably in the winter. If it appears on the preliminary examination that the old marks of pruning present rotten and soft wood, and there are no signs of the wound healing over properly, it would be well to give these special attention by cutting away until the wood looks fresh and healthy. If these new cuts are treated with paint as mentioned above nothing further can be done for them. In the case of roses and some other plants, if the tree has become much weakened, it would be well to keep it well pruned so as to encourage it to throw new shoots from below. These, if the roots are still good, will in time in certain instances replace the old trunk.

TECHNICAL NOTES ON CITRUS DISEASES.

Notes on the Gray Scab of the Orange.

THESE notes have reference to the scab on the fruit of the orange that afterwards becomes cracked, and which ultimately scales off, and leaves a smooth depressed scar, often of an elongated shape. A few weeks after its formation the scab contains minute black perithecia, carrying oval unicellular spores.

As soon as the scab is well formed, it will be found possible to remove it in a cleanly manner by working patiently with a small scraper. The scab comes away rather easily, except at certain points which are concentric with a darker colour, as if the new skin were attempting to form new oil glands. Even these parts can be removed by patient scraping, leaving the new skin quite whole and with a good natural-looking surface.

Microscopic examination of this new surface does not show any stomata, and there are no oil glands. The mycelium of the fungus appears to be confined to the scab, and it would appear that in the struggle for mastery the tissues of the orange come off best, so that the scab is shed.

The reason for the difficulty in the removal at the small points mentioned is that at these points the scab seems to be sunk deeper into the skin, for when it is removed there is left a small depression.

Fig. 132 shows a cross-section through one of the depressions where the scab has its firmest attachment.

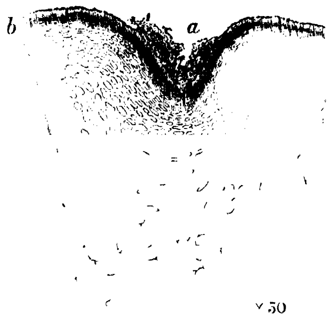


Fig. 132. Depressed portion of the gray scab of the fruit of the orange. Section through the attachment of the scab and a portion of the rind of the orange —*a*, the attachment point of the fungus; *b*, the surface of the fruit.

In addition to the fungus filaments and the conidia which they bear, there may be found in the scabby matter spherical perithecia with a distinct ostiole. The perithecia measure 100μ and the ostiole 15μ. On the leaves of trees bearing scabby fruit of this sort are sometimes to be found smallish spots which eventually become gray and papery, and this papery part at last falls out, leaving a "shot hole." The perithecia to be found in these papery tissues are of the same size, form and structure, as those in the gray scab. The spores derived from the perithecia on the leaves measure 7 x 2·6μ.

Cladosporium of the Orange.

Specimens of fruit and foliage of the orange have been received, somewhat attacked by a fungus belonging to the genus *Cladosporium*. I could not be certain whether this fungus disease was causing much damage. My doubt was increased in this case by the presence of a considerable number of scale insects on the specimens examined.

I am not aware that this particular species of *Cladosporium* found on the citrus trees has ever been specially treated with fungicides, and it is therefore impossible to say with absolute certainty what the results of treatment will be. There is, however, no reason to doubt that the application of Bordeaux mixture as for Melanose (?) will be entirely successful. The *Cladosporium* of the citrus tribe is so much like that of the peach and other stone fruits, as to make me believe that what will answer for one will answer for the other. It is known that Bordeaux mixture is efficient for the peach *Cladosporium* or peach freckle.

Diseases either caused by or associated with Bacteria.

It is now coming to be an accepted fact that bacteria are responsible for a number of diseases of plants. A dozen years ago there was hardly a single authenticated and well-known instance of such a disease, and even to-day the dispute continues in some quarters as to the trustworthiness of the evidence on this matter. Most of the instances mentioned below belong to the more authentic class of bacterial diseases of crops, though some are still in need of further investigation. Those who doubt the possibility of microbes being the cause of

disease in plants have as one of their final defences the assertion that microbes are not the primary causes in the cases held up as examples among plants of diseases of that nature. "A way has to be prepared for these microbes," it is said. Without at all admitting the truth of this assertion, one may ask to what extent can it be proved that the bacteria admitted to be the cause of various diseases of animals do not have to "have a way prepared for them"? Who knows the road by which bacteria enter the animal system sufficiently well to assert that no way is prepared? Possibly some of the remarkable instances of immunity are simply cases where no way has been prepared. Who can say? Is the freedom of adults from diseases peculiar to infancy because a way is no longer open? It seems to me that the proof of the ability, or otherwise, of a microbe to force its way unaided into the tissues is too remote a possibility at present to make it the universal main test of causation.

Gumming of the Sugar Cane.

This disease, though it continues to exist in the State, no longer causes uneasiness. During the last two years, not a single case of this disease has been referred to the Department of Agriculture. This appears to indicate that this disease, once so prevalent in certain parts of our cane districts, no longer attracts much attention.

A Mulberry Disease.

Occasionally the foliage of the mulberry is attacked by a peculiar disease. One of the symptoms is the appearance of microbic-nodules on the leaves. The mulberry is such a minor crop in this State that no attempt has been made to investigate the relation of this microbe to the disease.

Gummosis of the Tomato.

The Solanaceous plants suffer from an infestation of microbes, and occasionally samples of this disease are met with in this State; most frequently, I think, in tomatoes. The symptoms of the disease are of such a nature that growers would do well to trust to expert examination before resorting to combative measures. The attacked plants should be destroyed, and no attempt should be made to grow tomatoes, potatoes, or other solanaceous plants in the same ground for some time to come. In small, highly-valued gardens trenching, together with an attempt at disinfection, may be advisable in some instances.

The following are notes of a peculiar disease in tomatoes in which microbes were suspected to be the cause of the trouble. It was impossible to follow the matter further, for lack of suitable material. Some accurate coloured drawings of the diseased fruits were secured, and it is hoped that further progress may be made if further instances of the disease appear. On examination, the only micro-organism seen was in the form of bacteria in some of the stems. It remained undeterminable whether these had originated during transit, but it seemed probable that they had not so originated. In form, the bacteria closely resembled *B. termo*. The blossoms and fruit were the parts that seemed more particularly diseased. The blossoms seemed to be off colour, and the stamens appeared as if mouldy, but without yielding any satisfactory

EXPLANATION OF PLATE.

1. *Spermatia of Aecidium ranunculi repentis, after 48 hours in sugar and water; x 865.*
2. *Same as taken from the spermogonium; x 865.*
3. *Two capitate hyaline paraphyses of the uredo-spores of Puccinia anthoxanthi; x 170.*
4. *A basipetal series of aecidiospores of Chrysomyxa rhododendri, showing alternate abortive cells. After De Bary; x 510.*
5. *Spermatia of Aecidium ranunculi repentis, after 12 hours in sugar and water; x 865.*
6. *Spermatia of Aecidium bellidis; x 865.*
7. *Teleutospore of Triphragmium ulmariae, germinating; x 410.*
8. *Spermatia of Aecidium bellidis on 6th day in honey and water; x 865.*
9. *Abnormal germination of one of the uredospores of Puccinia graminis; x 410.*
10. *Teleutospore of Uromyces fabæ, germinating; x 170.*
11. *Spermatia of Aecidium bellidis, after 12 hours in honey and water, germinating; x 865.*
12. *Spermatia of Aecidium punctatum, budding; x 865.*
13. *Spermatia of Aecidium bellidis, after 12 hours in honey and water, germinating; x 865.*
14. *Promycelial spores of Puccinia phalaridis piercing by their germ tubes the cuticle of Arum maculatum; x 410.*
15. *Three teleutospores of Coleosporium senecionis, the upper cells of which have germinated and produced each one promycelial spore; x 260.*
16. *Spermatia of Puccinia adoxæ; x 865.*
17. *Aecidispore of Puccinia poarum, after 12 hours germination, showing circumnutation of germ-tube; x 410.*
18. *See No. 5.*
19. *Spermatia of Aecidium berberidis; x 865.*
20. *Aecidiospore of Gymnosporangium clavariæforme, with 6 germ pores; endochrome migrated to end of germ-tube; x 410.*
21. *Aecidiospores of Puccinia poarum; germ-tubes entering the stomata of Poa trivialis; x 410.*
22. *Teleutospore of Puccinia coronata, germinating; x 180.*
23. *Germ-tubes of the uredospore of Puccinia graminis entering stomata of wheat; 410.*

UREDINEÆ; ILLUSTRATIONS COPIED FROM TULASNE, DE BARY, AND PLOWRIGHT.

EXPLANATION OF PLATE.

(Altered from Tulasne.)

1. *Spores of Phragmidium incrassatum, Link, from the leaf of cultivated Rosa centifolia.*

2. *Spore of the same treated with sulphuric acid, and showing minute verrucosities: x 460.*

3. *Spore of Phragmidium obtusum, Schm. and Kze.; x 370.*

4 and 5. *Spores of the same fungus germinating and producing promycelial spores.*

6. *Spore of Uredo suaveolens, Pers., showing 3 germ-pores; x 460.*

7. *Promycelial spore of Phragmidium bulbosum, Schmidt and Kze., which has germinated and produced a secondary spore.*

8. *Spores of Phragmidium bulbosum, two cells of the larger of which have germinated.*

9. *Germinating spore of Uredo suaveolens, Pers.; x 460.*

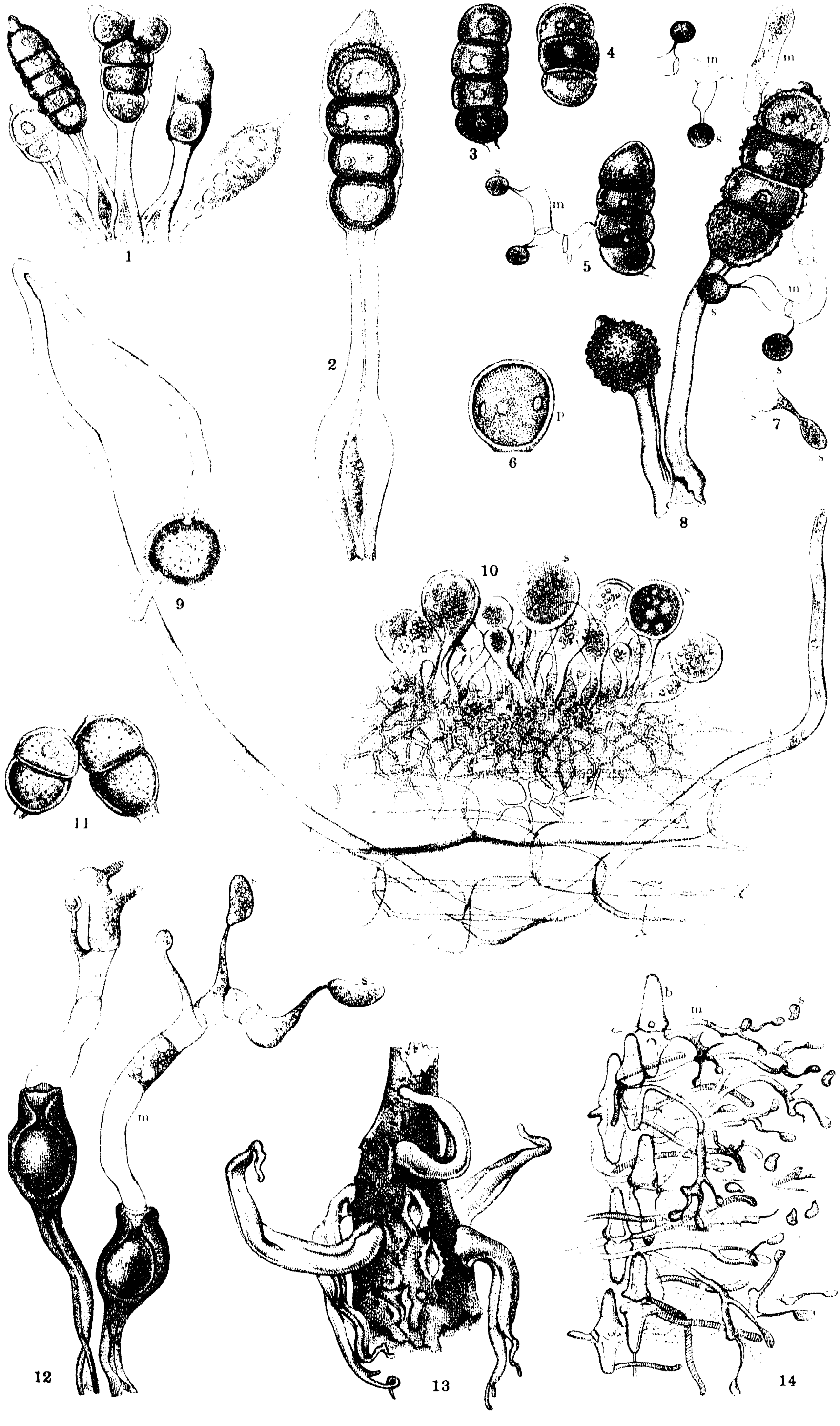
10. *Uredo suaveolens, Pers., in Cirsium arvense; x 430.*

11. *Teleutospore of Puccinia compositarum, Schl., from leaves of Cirsium arvense; x 460.*

12. *Teleutospores of Uromyces appendiculatus (Fabæ), Lk., which have germinated and produced promycelial spores; x 430.*

13. *Podisoma juniperi communis, Fr.*

14. *Longitudinal section through one of the growths shown in 13; the right side of the figure shows the surface of the fungus and the manner of producing promycelial spores.*



UREDINEÆ; ILLUSTRATIONS COPIED FROM TULASNE.

EXPLANATION OF PLATE.

1. Part of a section through a sorus of Coleosporium sonchi, Lév., from Sonchus oleraceus, L.—b, multicellular spores; f, promycelial hyphæ issuing from the germinating spores; s, promycelial spores.

2 and 3. Promycelial spores of Coleosporium tussilaginis, Pers., germinating.

4. Germinating promycelial spore of Coleosporium sonchi, Lév., which has produced a secondary promycelial spore; x 460.

5. Section through a sorus of Melampsora salicina, Lév.—u, uredospores; p, m, teleutospores; x 240.

6. Four spores from a sorus of Coleosporium tussilaginis, Lév. One of the two that have germinated has produced promycelial spores at the ends of the promycelial hyphæ; x 320.

7. Promycelial spore that has germinated and produced a secondary promycelial spore; x 340.

8. Uredospores and paraphyses of Melampsora betulina, Desm., from Betula alba, L.; x 330.

9. Uredospore of Melampsora salicina, Lév., germinating.

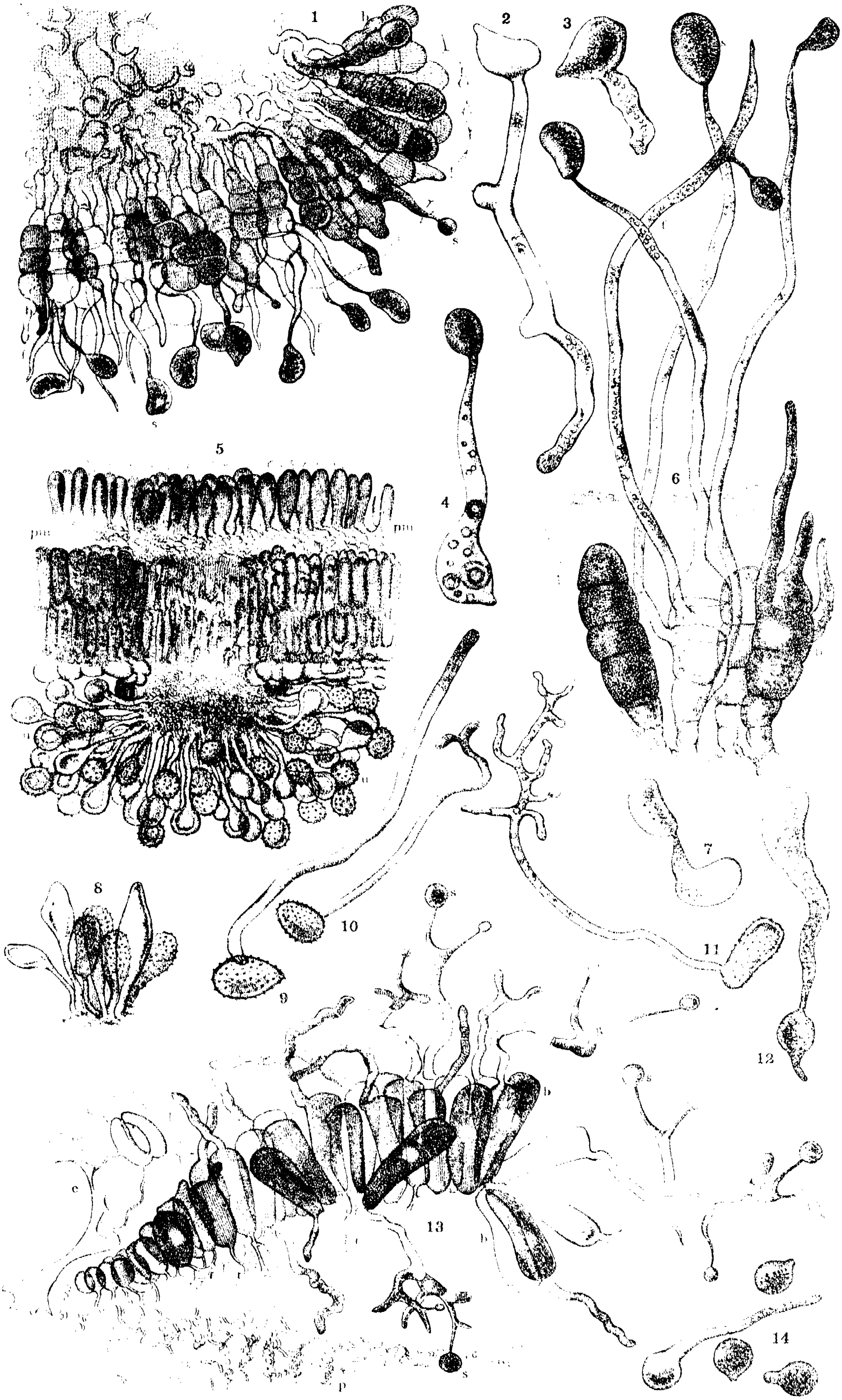
10. The same as 9.

11. Uredospore of Melampsora populina, Lév., germinating.

12. Promycelial spore of Coleosporium tussilaginis, Lév., germinating; x 330.

13. Part of a section through a sorus of Melampsora betulina, Desm., from Betula alba. r, hyphæ; b, teleutospores; s, promycelial spores; e, stomatum; p, parenchyma.

14. Promycelial spores of the same fungus beginning to germinate; x 460.



UREDINEÆ; ILLUSTRATIONS COPIED FROM TULASNE.

EXPLANATION OF PLATE.

1 to 5. Germinating uredospores of Cronartium asclepiadeum, Fr.; x 330, except Fig. 3, which = x 370.

6 and 7. Base of the ligules accompanying the uredospores.

8. Transverse section through a ligule, showing the same to be solid, not tubular.

9. A ligule in process of germination.

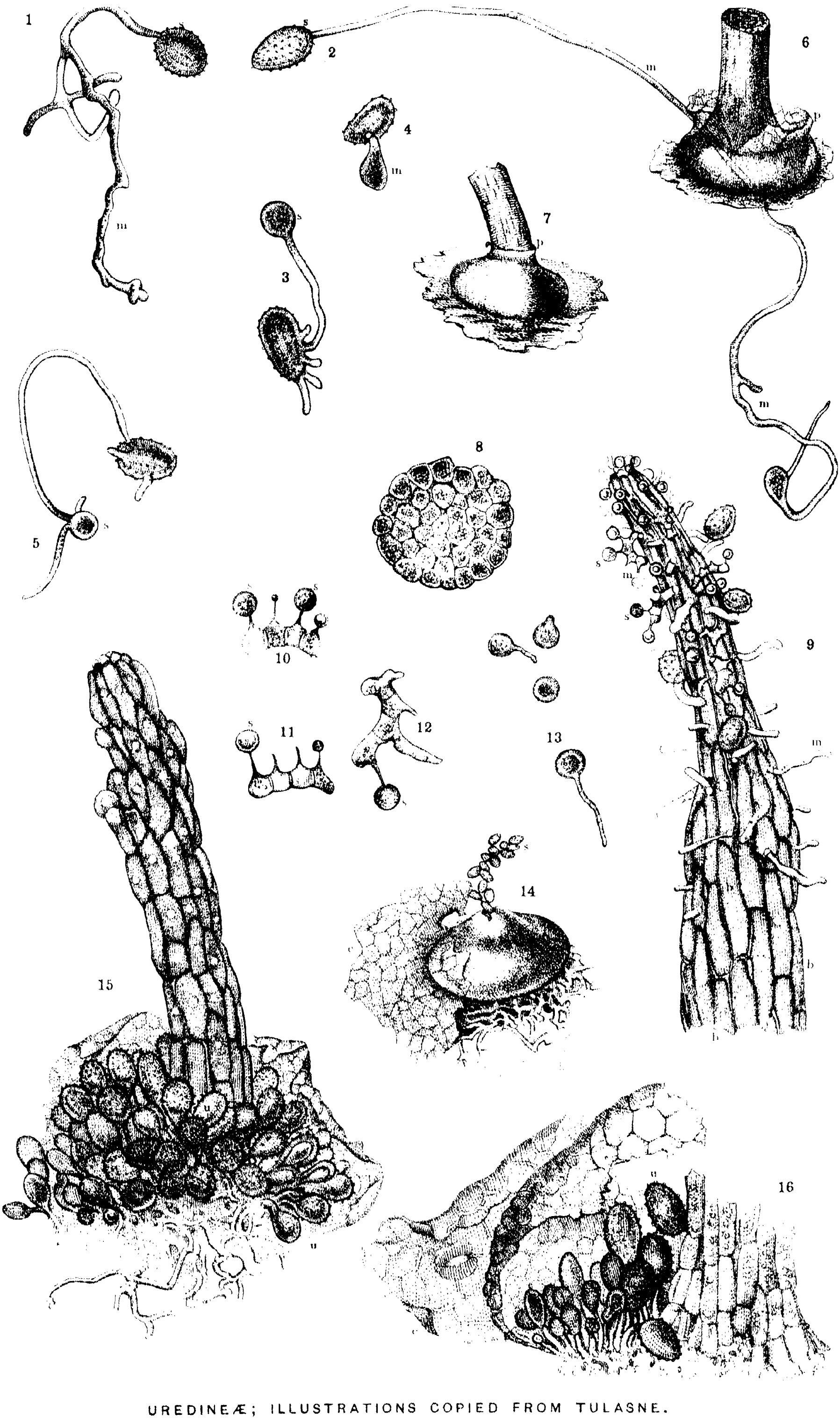
10, 11, and 12, show more precisely the manner of producing the promycelial spores.

13. Promycelial spores germinating.

14. The uredo sorus of Cronartium asclepiadeum, showing the uredospores escaping through an aperture in the peridium.

15. Section through a more advanced uredo sorus after the appearance of the ligule; the peridium is thrown back, and shows the manner of growth of the uredospores; x 230.

16. Section of the same, taken longitudinally through the axis of the ligule.



UREDINEÆ; ILLUSTRATIONS COPIED FROM TULASNE.

data. The hard, green fruit had a pronounced mottling of ivory white. In some cases the half-grown fruit appeared more white than green, and the white tended to occupy the blossom end, while the green tended to occupy the stem end of the fruit. As the fruit ripened the white parts became yellow while the green parts became red, and as the yellow parts appeared somewhat watery the outward appearance of the "ripened" fruit reminded one somewhat of a water-cored apple. The taste of the ripened fruit was insipid, or somewhat offensive and slimy. No microbes were seen in the fruit. The plant was said to have been grown in a dry season, and to have been sufficiently watered. The fruit was smooth and bright, with no other appearances of external disease. The only conclusion reached was that the disease might be of bacterial origin. The season was very dry.

Black Spot or Fusicladium of the Apple and Pear.

The fact that a number of diseases of the apple and pear cause dark-coloured spots renders the name Black Spot unfortunate for any one of them, but in spite of the mistakes resulting from this nomenclature, some of them costly, it seems useless to protest against it. Any grower who feels himself at all uncertain about the appearance of this disease may save himself trouble and needless expense if he will submit specimens to an expert before expending much money on combative measures. Some varieties of apple and pear are so very much more susceptible than others to *Fusicladium* that treatment with fungicides is not likely to be profitable in a season favourable to the disease, like that of 1903, unless the treatment is very thorough. The fungicides must be well made and well applied. Both these features of the case have been previously mentioned in these letters, but the importance of the subject justifies repeated reference to it. The double method of spraying described on a previous page (p. 650, July, 1903) might be developed into a triple or even multiple method with advantage in extreme cases.

For reasons that are quite beyond our present knowledge, crop diseases vary much in their intensity from season to season, and it is quite probable in some orchards where treatment for these diseases is the rule rather than the exception, that in some instances treatments are made that are not a paying investment if considered apart from the general average of loss. If having insured my property I am blessed with freedom from loss by fire, and then complain that my insurance money has been wasted, I take up an unsound business position. Knowing this, I am not disturbed by my careless neighbour, who carries no insurance, even if he should twit me on my vanished premium while flaunting his own cash in hand "saved" by ignoring the precaution of insuring. In a somewhat analogous manner an orchardist need give himself no serious concern if, in some seasons, he sees his neighbour, who does not spray, harvest just as good crop as his own. Of course, if we could know beforehand the exact nature of the coming season, we might sometimes with advantage dispense with some of our treatments, just as if we could know beforehand that no fire would occur on our property we could dispense with insurance. The difficulty is that we cannot know these things beforehand.

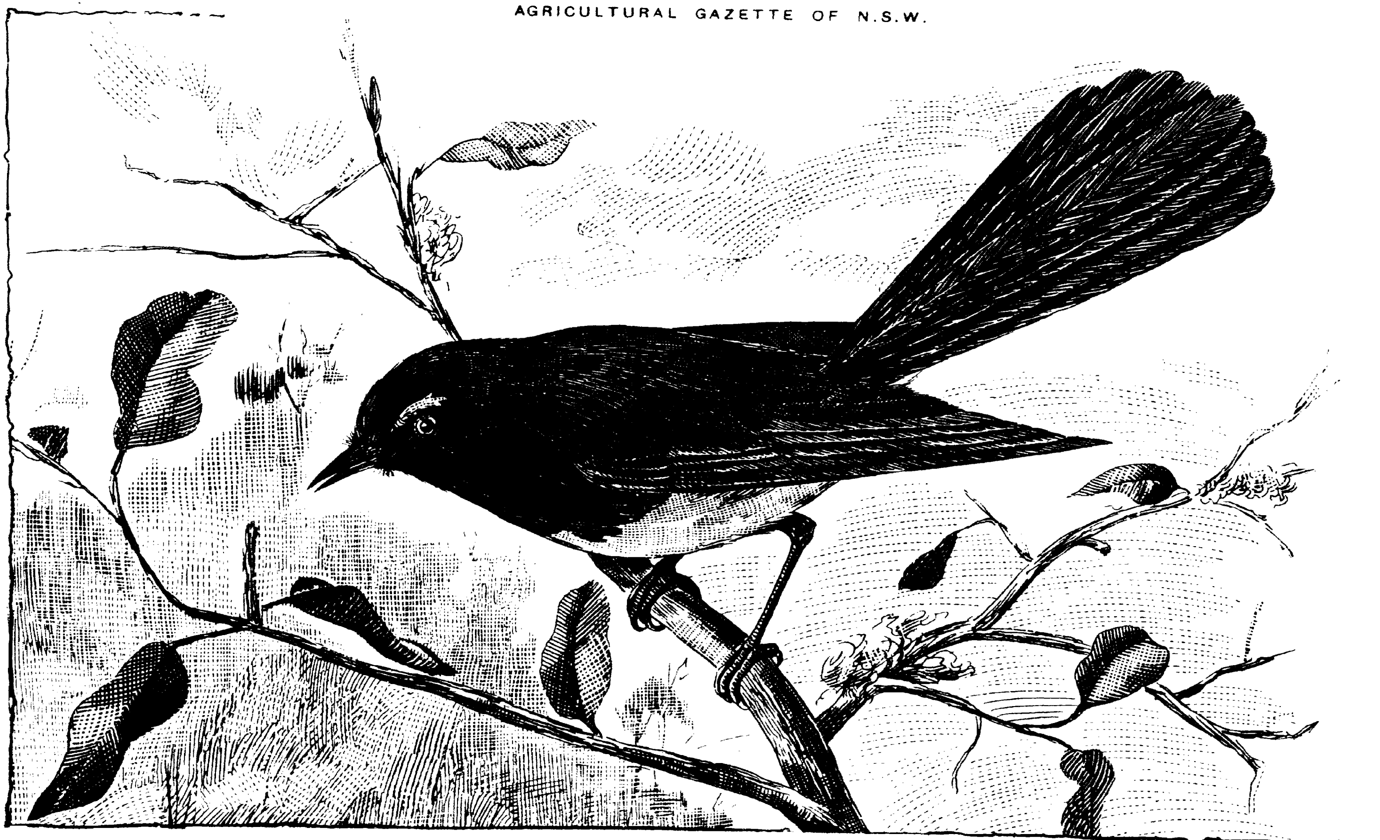
Nature Study.

The Willie Wagtail.

WALTER W. FROGGATT,
Government Entomologist.

In this bright sunny climate, Nature has clothed our hills and fields with a profusion of plants and flowers with their attendant birds and insects, but it is perhaps this very abundance of plant and animal life that is responsible for a careless disregard of the study of our surroundings. They are too common; yet, as Professor Huxley said, "Science is only common sense applied to common things," and every child living in the bush could be a "bush naturalist"; he has not the advantages of the city child in many things, but, with a little direction, he could be taught to think, and find pictures in the fields and sky, and a museum in Nature's workshop round his feet, and thus fill up many happy hours quite as profitably as the city child. Birds cannot be studied and their secrets and habits discovered without living among them. Who can tell what wonderful thoughts are passing through the little brain of the hen robin perched on the post, or her vagabond city cousin, the sparrow, stealing the canary's seed?

In the days when the great western plains and scrubs were parcelled out into sheep runs, and fences were an unknown thing, the dividing boundary between the stations was a vague and elastic line. Then



"Black and White Fantail."

every flock was tended by a shepherd, who saw no human face in many cases from week to week, except when the ration cart came out to bring his supplies, or the irregular visits of the overseer. There were hundreds of these men—afterwards supplanted by boundary riders as the runs were fenced in—who lived solitary, lonely lives, as far as human companionship was concerned, but they had other friends beside the grave-faced collie, who learnt to know every movement of his master's face in the long, silent watches on the plains. Among them was a little bird, for, come when you would, you would find the "Shepherd's Companion" perched upon the ridge-pole of the bark hut, or fluttering round the tree beside it, and as the flock came tailing out of the sheep-fold he would fly down and perch upon their backs, his bright eye soon discovering any belated fly and his sharp bill soon making short work of it; then up he would dance and flutter with his bright, chattering cry that the children say resembles "Sweet, pretty creature," and if not too late, or otherwise engaged, he always met the flock coming home. No wonder that the silent, lonely men came to love these merry

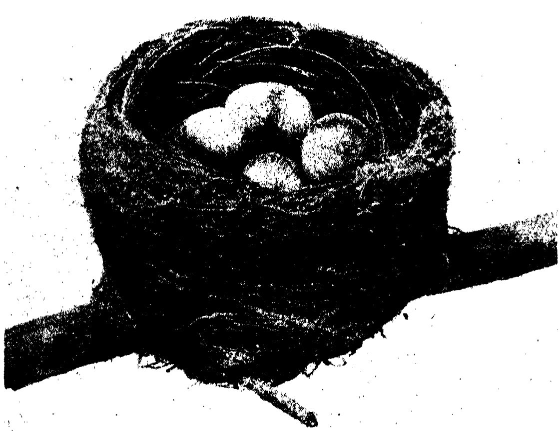
little black and white sprites, and the "Willie Wagtail" of the coastal districts became known all over the west as the "Shepherd's Companion."

It is almost impossible to find any homestead out in the west—unless it is over-run with that enemy of bird-life, cats—where there are not a pair of these birds, which have taken up their quarters, and the first thing the stranger hears on waking in the morning is the greeting of the "Willie Wagtail" on the tree outside his window; and if he has spent a restless night in his strange bed, he will have

heard at intervals all through the night, particularly if it has been bright moonlight, the sharp, clear call-note of the pair from their roosting place, breaking the silence of the night, like the old watchman's cry of bygone times of "All's well."

As Mr. Wagtail is preening himself in the morning sun, his restless black tail is constantly on the wag, from which he gets his other common name of "Willie Wagtail"; but he is not a true wagtail; and, though he resembles the pied wagtails of Europe in outward appearance and colouration, he is a fly-catcher, and instead of wagging his tail up and down our friend flirts it in the opposite way, from side to side. He has had a number of other popular names given to him by different writers, which may be more accurate from a scientific point of view, such as Black Fantail, Black and White Fantail, Water Fantail, but they will never supplant the good old bush names of "Shepherd's Companion" and "Willie Wagtail." Gould says that the natives of Western Australia called this bird "Jit-te Jet-te," which is evidently their interpretation of its call-note. It was described a great many years ago by two naturalists, Messrs. Vigours and Horsfell, under the scientific name of *Rhipidura motocilloides*, the first or generic name being compounded of two Greek words, *Rhipis* a fan, and *Oura* a tail, and the second or specific name from the Latin word *motacilla* a wagtail, thus translated "the Fantail Fly-catcher."

They are dainty artificers, constructing a beautiful, soft, cup-shaped nest composed of grass, bits of bark, wool, hair, and any other suitable material they come across in their rambles, delicately woven together into a soft, felted mass, bound all over and around with spider-web, so that when their labours are finished it is so neatly attached to the limb that it has no angles or sharp outlines, but blends into its surroundings so thoroughly that you would never suspect that it was a nest, but pass it quite closely, under the impression that it was simply an excrescence or lump on the limb.



The choice of situation of the nest is guided by the surroundings, but where the writer was well acquainted with "Willie Wagtail," in the north-western district of Victoria, it was generally placed on a dead limb standing out of a living tree; and if the birds were out

visiting, or warned of your approach to get away from the nest, it took a very sharp eye to locate the spot, however sure you were that the knowing pair had been beside it only a moment before. So it was bird-cunning against boy-craft; and unless, like a blackfellow, you had unlimited time, the retreat of Mr. and Mrs. Willie Wagtail generally remained undiscovered. If, however, you surprised the hen when sitting on the nest, she generally laid low and made no sign, trusting that her projecting tail would pass muster, while her husband came bustling up, watching you out of the corner of his eye, chattering all the time, and aimless flights towards the nearest tree, evidently trying to explain to you that there was the proper place to look for the nest. If, however, you are not beguiled by his tricks, but find it, and he sees that discovery is inevitable, and you commence to climb the tree, back he comes in a great state, crying, in true bird language, in a note quite different from his morning greeting—a compound of sorrow and anger. Having found the nest, you will seldom have any difficulty in getting up to it, and as the frightened mother flies off she discloses three or four—the number is variable—dull, white eggs with a greenish tint, ringed towards the broadest end with a zone of dull, brown, and blackish spots and blotches, nestled in a soft bed of feathers and rootlets.

Now, unless you are a very hard-hearted and thoughtless boy—and remember "that more evil is wrought by want of thought than ever by want of heart"—you will only have a peep and then climb down again. Don't even touch the eggs, or the sensitive little mother may abandon her nest. You will get a great deal more pleasure in watching the upbringing of the family if you have time and opportunity to visit the neighbourhood every few days, and you will soon gain the confidence of the little feathered creatures, who will take no notice of your presence; and the queer-looking little nestlings one morning will poke up their little bald heads, all eyes and mouth to enquire what you have brought them to eat, for at this stage they are very like other babies—have nothing to do but eat, sleep, and grow—and it takes Mr. and Mrs. Willie Wagtail all their time keeping these clamouring, squeaking, little bunties quiet when insects are scarce, but they manage it somehow. If the home is well chosen, and the babies escape the many ills and enemies that await every small life, the proud time comes when all the down is replaced with feathers and the boldest of them climb on to the edge of the nest and meditate about the art of flying, and it is probably a very proud moment in our little friends' life when they start the fledglings on their first flight and launch the young folks out in the world on their own account.

I am quite certain that any boy who has watched such a little family would never intentionally destroy a nest, and if the writing of this little paper saves the life of one of God's little creatures it will not have been penned in vain.

Vinification in Wet Vintages.

M. BLUNNO.

THE coming vintage might be one for which the wine-maker of this State will have to set aside all arrangements for refrigerating the grape juice, such as have been found indispensable for the last six or seven years of dry hot weather prevailing during the vintage months. His trouble, perhaps, will be to have to handle a crop of grapes not very sound and clean. I have already received specimens of vine-shoots showing that Black Spot is pretty widely spread this year, oïdium is also likely to do damage, and if rains should extend over the wine-making season other moulds are sure to infest and deteriorate the fruit.

The berries will swell abnormally, the skin will be thin, but not firm, and under the inside pressure of the water will burst, offering thus an inroad for the *Botrytis cinerea*, a grey mould, to grow and spread. The *Botrytis* will destroy a certain amount of the grape sugar and acids, also, by secreting a specific *oxidase*, will oxidise the coloring matter stored in the skin and render it insoluble, whereby wines will be poor in colour, flat, and difficult to clarify. These inconveniences, however, may be averted by following a suitable method of vinification. A matter of first importance to wine-growers is not to mix with the grapes any bunch which shows green, black, or yellow moulds. I wish to draw a distinction between mouldy and rotten grapes.

Berries may be covered with the grey fungus, the *Botrytis*, and turn out a very good wine (white). As a matter of fact, in many European countries famous for white wines, the advent of *Botrytis*, concomitant with certain weather conditions, which will limit the infection to the skin, is looked forward to. For the sake of distinction I shall call these mouldy grapes, but grapes are rotten when the *Fumagine*, *Mucor*, *Penicillium*, *Ploeospora herbarum* and the putrefaction bacteria have invaded the pulp of the berries.

It is easy to instruct grape pickers to make the above distinction, and the foreman should look out sharp to see that the irresponsible pickers, as a rule school boys and school girls, or adventitious men, do not fill the bucket with anything, as in most cases they are paid by the number of buckets they fill and carry to the cart.

Those wine-makers who, in wet weather delay the vintage waiting for the grapes to reach the usual standard of sugar, do so at their own risk. More often than not the standard is not reached, and the continuous rain dilutes the juice and the crop is partially or totally deteriorated by fungoid growths. Knowledge is general on this point, but I shall refer here to some experiments showing the extent of loss in quantity and quality.

Müntz* made some interesting experiments quite recently on the influence of the grey mould on the quantity and quality of wine. The grape experimented on was the Carignane. Here are the results:—

	grapes per acre.	alcohol per hundred.	acids per thousand.
Grey mould makes its appearance	5 tons 2 cwt. 2 qrs.	9°.3	7.1
All the crop is covered with grey mould...	2 tons 16 cwt. 2 qrs.	8°.5	6.3

The *Botrytis* having also interfered with the coloring matter of grapes, the following figures show how the color intensity also differs:—

	intensity of color
Sound grapes	10 ruby
Grapes showing first signs of grey mould	7 brown
Grapes badly affected	4 yellow

Like the coloring matter the tannin is also destroyed, thus Müntz found in

	Tannin
100 parts of sound berries	1.9
100 parts of mouldy berries	0.4

Against the decrease of alcohol, acid, color and tannin, is to be put an increase of the extractive matters in general, especially in the quantity of glycerine. It is evident then that the equilibrium of the constituents of the wine from mouldy grapes is thus broken. It is to be understood that I am not speaking here of the particular stage of the *Botrytis* known as *noble putrefaction*,* such as sometimes occurs in the Sauterne, Rhine, Tokay, and Roman Castles districts. All varieties of grapes will not undergo the noble putrefaction, and for those which do certain weather conditions must obtain. When the *Botrytis cinerea* makes its appearances just as the grapes are ripening, and afterwards the weather keeps warm and dry, then this desired alteration will take place, but if it should continue wet the *putrefaction is noble no longer*.

A local knowledge of the weather prevailing at vintage time in each district, will help the wine-grower to decide as to the time for beginning his vintage. Generally he will find that anticipating it is the surest course. Thereby no fear is to be entertained of the juice containing too much of free acids to give the wine a green taste of unripe apples. Under a warm climate, like that of this State, it is never the case, and if the percentage of grape sugar is lower than in dry years the same will be the case with the proportion of the free acids, because the excess of rain will dilute both sugar and acids alike. Nay, in this State in a wet vintage, it is more necessary to increase the proportion of free acids by adding an average of 1lb. of tartaric acid for every 100 gallons of must without the skins, as well as increasing the proportion of tannin through the addition of tannic acid from 2oz. to 4oz. every 100 gallons, preferring the higher if grapes are grown in flat land, deep, and rich in humus.

*Vide Annales Agronomignes, 1902.

*German—*Edelfaüle.*
French—*Rot noble.*
Italian—*Uve infavate, putrefazione nobile.*

The increase in the quantity of free acids will not only help fermentation, but will produce a wine with a more pleasant taste that will remind one of the fruit from which it is obtained, will live and keep improving, will mature and get old before it gets decrepit, as is the case with many Australian wines.

The tannic acid in the first instance helps to make insoluble a great quantity of organic matters which, when white wines are made, can be thus separated before even fermentation begins. In consequence, when this sets in, the must is clearer and so will be the wine, through the earlier and larger quantity of lees precipitated.

The natural tannin, which in a wet vintage is rather deficient in red grapes, not so much because it has been diluted, as because it has been partially destroyed or made insoluble by moulds, has a complex function in the wine. It helps to maintain together the other ingredients, it fixes and makes more stable the coloring matter, and concurs with the other free acids to the sound keeping of the wine. An excess of tannin impresses the palate with astringency, which in young wine is to be preferred to deficiency. Young red wines that taste mellow and soft will not keep long, and will not improve with age, and are more palatable when young. Excess of tannin is to be preferred to deficiency in young red wines, which for the quality of grapes employed in making and through the nature of the soil in which they were grown, are apt to give with age a high class of wine. The early astringency disappears in time, the tannin being slowly oxidised, and at any rate, its proportion may be toned down at any moment by fining the wine with albuminous or gelatinous substances, which form, with the tannin, insoluble tannates.

White Wines.

Grapes are not put through the crusher but taken directly to the press, and the juice extracted is put into large tubs or vats. Tartaric acid is dissolved in some warm must and mixed with the bulk, also the tannic acid in the proportions given above. Then it is submitted to strong aeration, which is best accomplished by pumping air in it for an hour. If meta-sulphide of potash is available, 1½ oz. of it is previously dissolved in a little warmed must and then mixed to every 100 gals. If no meta-sulphide is available, ½ oz. of sulphur is burned under a hogshead from which one end has been removed, and the fumes are pumped into 100 gals. of must. The liquid is then allowed to rest for 24 hours, during which a thick crust forms on the top, and this is removed as it forms. Then the must is removed from that vat in order to separate it from the heavy sediment that is collected at the bottom, and placed in another vat or cask.

A couple or more buckets of must, obtained from carefully selected clean grapes, is mixed with the bulk. This must when mixed should be in full fermentation, its role being that of starting fermentation of the whole. Culture yeast obtained from a reliable laboratory may be used instead.

If fermentation was made in an open vat, then the wine is racked into a cask as soon as it is over, and a fortnight later is placed in

another vessel. If fermentation was made into a cask, then the wine may be allowed to remain a week to give it a chance to rid itself of the heaviest lees, and then it is removed into another vessel.

Red Wines.

If portion of the red grapes are sound and clean, these are made into wine separately. The husks left after the fermentation are employed a second time to give color to the must obtained from the mouldy grapes, which are pressed like the white, and the must treated as if it was intended to make white wine, but before fermentation sets in, it is thrown on the red skins of sound grapes, and the usual method for making red wine is then followed. If, however, no skins of sound red grapes are available, then mouldy red grapes are stemmed and crushed, juice and skins are put to ferment together, tartaric acid and tannin is added, and a few buckets of starter are mixed. As soon as the liquid has contracted enough red color it is withdrawn so that the contact with deteriorated grape skins may be as brief as possible.

White Wine from Red Grapes.

With a bad crop of red grapes it is better to make white wine out of them, which will be far better than the red wine would be. To this effect grapes must not be put through the crusher, but only pressed as quickly as possible, and not very hard. However, only the first of the juice available in the grapes would give an absolute white wine, a light pink tint would soon follow, and become deeper as the pressing proceeds.

If the wine maker is satisfied to collect only the small portion of juice that runs first, and is white, and make this into white wine as if it were from white grapes, he can collect the other portion and make it ferment with the skins to make red wine. But if he wishes to make as much white wine as can be possibly made out of red grapes, then he must deal with a pink must, and judge for himself at what point of of coloration he should separate this from the balance, which will run more and more colored.

The first operation on this pink juice is a very strong aëration by pumping air in it for a couple of hours. No addition of either tartaric or tannic acid is to be made, which would fix the color rather than helping to remove it. The aeration is then followed by the mixing of 3 ounces of potash bi-sulphide, which will prevent fermentation from starting for about 48 hours. All the crust of solid matter formed on top of the liquid is removed, and then the juice is run into another vessel, vat, or cask, but from one to one and half pound of animal charcoal is mixed to every 100 gals. of must. The best way to do this is to first add the animal charcoal in 3 or 4 buckets of must causing it to distemper thoroughly by energetic stirring, afterwards this is thoroughly incorporated with the bulk by continuing to stir the whole. As soon as fermentation begins, the particles of coal will be tossed about by the bubbles of carbonic acid continuously creeping through the liquid mass, and only when fermentation ends the powder will

begin to settle. A week or so after fermentation is over the liquid is racked into another vessel; some particles of the coal will be still in suspension, and the wine will show a dark hue, but a fining with gelatine or blood as soon as cold weather sets in will drag them all to the bottom.

White wines are very poor in tannin, if they contain any at all. When clarifying with gelatinous or albuminous substances, it is necessary that a certain proportion of tannic acid be previously dissolved in wine to help the precipitation of the fining. Four oz. of tannic acid to every 100 gals. of wine is the proportion. This will not remain in solution after the clarification, but will combine with the gelatine or albumen used for fining, and will precipitate and collect at the bottom of the vessel under the form of tannate.

Animal charcoal can be bought which is specially prepared for use in wine making and wine treatment. Ordinary animal charcoal contains a high properties of lime phosphate and alkaline carbonates which would neutralise portion of the acidity of the grape juice.

Quality of Ingredients.

The tartaric acid employed in correcting the deficiency of acids in the grape-must should be pure, that which is sold in crystals is the best. The tannic acid is obtained from the oak, and other trees. It is extracted through ether, alcohol, or water. That extracted through alcohol is the best.

Cattle and Horses—Ringbarking Trees.

Mr. W. M. Fleming, M.L.A., writes:—"The practice of bark eating by cattle, sheep, and especially horses, is by no means an uncommon one. It is generally attributed—I think rightly—to want of salt, and occurs more frequently in dry times. In the Hunter District the apple-box tree is an especial favourite with horses, in odd cases trees having been killed by them. On the plains, the grey-box, or as some call it, the pepper-box, appears to be the best liked, and it is quite a common occurence for a horse to take a few bites at the hard, rough bark of green belar and chew the little he gets with apparent relish.

Apropos this matter, it is worthy of notice that what in some districts is readily eaten by stock, will in other districts not be touched by them except under pressure. A good instance of this is the common ornamental pepper-tree so often growing beside homestead house-rails."

Pot Experiments to Determine the Limits of Endurance of Different Farm-Crops for Certain Injurious Substances.*

By F. B. GUTHRIE and R. HELMS.

[**Read before the Royal Society of N. S. Wales, September 2, 1903.*]

Part II.—Maize.

The experiments here recorded are in continuation of similar experiments with wheat[1], and were conducted in a similar manner. A description of the pots used, and the manner in which they were filled and treated, is fully given in the previous paper, and need not be here repeated. Mr. Maiden kindly set apart a space in the Botanical Gardens for the purpose of the experiments, which were conducted in all details in the same manner as the preceding.

Nature of Soil.

The soil with which the pots were filled was a fairly rich garden loam mixed with nearly an equal quantity of light sand.

The composition of the soil was as follows:—

Moisture ...	1·13
Organic matter ...	8·14
Nitrogen ...	·202
Soluble in strong HCl.	
Lime ...	·257
Potash ...	·112
Magnesia ...	·069
Phosphoric acid ...	·107

Each pot received in addition 10 grms. of superphosphate. Several check-pots were filled in exactly the same way, with the exception that the deleterious substances were omitted. All the pots were exposed to exactly the same conditions as to light, warmth, water, &c., throughout the course of the experiments.

Experiments with Common Salt.

Eight pots were filled with the soil and superphosphate, together with the following quantities of common salt per 100 lb. of soil:—

No. 41, ·10 per cent. of NaCl.	No. 41, ·10 per cent. of NaCl.
„ 42, ·15 „ „	„ 46, ·35 „ „
„ 43, ·20 „ „	„ 47, ·40 „ „
„ 44, ·25 „ „	„ 48, ·50 „ „
„ 45, ·30 „ „	

[1] *Agricultural Gazette*, February 1903, page 114.

The pots were sown on October 24th, 1902, with 7 maize kernels in each pot, the surface being covered with a mulch of shredded cocoanut fibre, and the soil kept moist throughout the experiment.

The following notes were made on November 3rd with regard to the germination :—

Pots 41 and 42 had germinated well.

In 43, 44, 45, the germination was retarded.

In 46 much, and 47 very much retarded, whilst in 48 the seeds did not germinate.

On November 21st the further growth of the plants was noted :—

In Nos. 41 and 42 the growth was fair, but quite markedly affected.

In No. 43 the growth was very strongly affected.

In Nos. 44, 45, and 46 the plants were dying and very nearly dead.

In No. 47 the plants were quite dead.

As the growth was affected by the smallest quantity taken (Pot 41), three pots were resown on November 28th, with smaller proportions of salt :—

No. 49	with	·025	per cent.	NaCl.
„ 50	„	·050	„	„
„ 51	„	·075	„	„

All these germinated well and were growing well on January 15th, 1903, showing that a quantity of NaCl. below ·1 per cent. has no injurious action on the growth of maize.

From the above it is concluded that the germination of maize is unaffected by the presence in the soil of sodium chloride up to ·2 per cent., and that between ·4 and ·5 per cent. prevents germination.

The growth of the plant is markedly affected by ·1 per cent. of sodium chloride, and plants will not grow in soil containing ·25 per cent. and upwards.

Experiments with Sodium Carbonate.

Eight pots were filled with soil, manured with 10 grms. superphosphate each, and sown with seven maize-kernels on October 24th, 1902. The quantities of sodium carbonate previously added to the different pots were as follows :—

No. 52,	·10	per cent.	Na_2CO_3	No. 52,	·10	per cent.	Na_2CO_3
„ 53,	·20	„	„	„ 57,	·40	„	„
„ 54,	·25	„	„	„ 58,	·50	„	„
„ 55,	·30	„	„	„ 59,	·60	„	„
„ 56,	·35	„	„				

On November 3rd the following notes were made as to their germination :—

No. 52 had germinated perfectly.

In Nos. 53 and 54 the germination was slightly retarded, more so in 55 and 56, very much retarded in 57, whilst the seeds of 58 and 59 had not germinated.

The growth of all was more or less affected.

On November 21st the plants of pot 52 were growing well, though the effect of carbonate of soda was noticeable. This was somewhat

more marked in 53, whilst in 54 the growth was strongly affected, and in 55, 56, 57, 58, and 59 the plants were all dead.

The conclusions drawn are the following:—Quantities up to ·1 per cent. carbonate of soda in the soil is tolerated by the maize plant, and are without effect upon the germination or subsequent growth. ·1 per cent. already acts as a poison to the growing plant, the effect of which is more and more marked up to between ·25 and ·30 per cent., at which point the plants die. The germination is slightly affected by ·2 per cent., and ·5 per cent. prevents germination.

Experiments with Ammonium Sulphocyanide.

Six pots were prepared, as in the previous experiments, with the following quantities of sulphocyanide, and sown on October 24th:—

No. 60, ·001	per cent.	NH_4CNS.	No. 60. ·001	per cent.	NH_4CNS.
„ 61, ·002	„	„	„ 64, ·005	„	„
„ 62, ·003	„	„	„ 65, ·006	„	„
„ 63, ·004	„	„			

On November 3rd, Nos. 60 to 63 had germinated well. In Nos. 64 and 65 the foliage had become spotted.

On November 21st, Nos. 60 to 63 were growing fairly, though all showed signs of the effect of the salt, and were not so vigorous as the check plants. Nos. 64 and 65 had recovered in colour, but the growth was somewhat stunted.

Three more pots were sown on November 28th, containing somewhat larger proportions of sulphocyanide:—

No. 66, ·008 per cent.
„ 67, ·01 „
„ 68, ·02 „

Nos. 66 to 67 germinated fairly, but slowly, and not vigorously, and No. 68 was somewhat more retarded. Their subsequent growth (January 15th, 1903) was more strongly affected.

The results show that proportions of ammonium sulphocyanide as low as ·001 per cent. already affect the growth of the plant, though it will germinate freely until the amount reaches ·005, when the germination is not so vigorous, and the young leaves are discoloured. The points at which germination and growth are actually prevented was not reached, but they are certainly very near ·02 per cent. A further series will have to be sown in order to establish this point.

Experiments with Sodium Chlorate.

Six pots were prepared, as in the previous instance, with the following quantities of sodium chlorate:—

No. 69, ·001	per cent.	$NaClO_3$	No. 69, ·001	per cent.	$NaClO_3$
„ 70, ·002	„	„	„ 73, ·005	„	„
„ 71, ·003	„	„	„ 74, ·006	„	„
„ 72, ·004	„	„			

The results are as follows:—November 3rd, Nos. 69, 70, and 71 had germinated freely; No. 72 showed the effects of the salt, germination being slightly retarded; in No. 73 the foliage was discoloured,

and in 74 the germination was very feeble and the young leaves discoloured and puny.

On November 21st the growth in No. 69 was fair but distinctly affected. In Nos. 70 and 71 the growth was more strongly affected, the leaves in 71 having a bleached appearance. In 72, 73, and 74 the leaves were quite bleached and the plants dying.

It is then seen that the germination is unaffected till the amount of chlorate reaches ·004 per cent., and that quantities above ·006 per cent. prevent germination. The growth of the plant is affected by ·001 per cent., and that when the amount reaches ·004 per cent. the plants are killed.

Experiments with Arsenious Acid.

Six pots were filled and sown on October 24, the following quantities of arsenious acid having been previously added :—

No. 75, ·05 per cent. As_2O_3	No. 78, ·30 per cent. As_2O_3
,, 76, ·10 ,,	,, 79, ·40 ,,
,, 77, ·20 ,,	,, 80, ·50 ,,

On examining the pots on November 3rd germination was found to be unaffected except in the case of No. 80, in which the germination was somewhat retarded.

On November 20th the growth of No. 75 was very slightly affected, the effect increasing in the succeeding numbers. In No 77 the growth was somewhat stunted, and more markedly so in 78, 79, and 80; though the plants were small, they looked fairly healthy.

Three other pots were sown on November 28th :—

No. 81, ·60 per cent. As_2O_3
,, 82, ·70 ,,
,, 83, .80 ,,

On December 13th it was found that the germination had been affected in all cases. In No. 83 it was very strongly affected, and the plants were very feeble. Above this point germination would certainly be prevented. The plants in Nos. 81 and 82 were nearly dead by January 15th, and in No. 83 quite dead.

The germination of maize is, therefore, not affected by the presence of arsenic in the soil up to ·4 per cent.; at ·5 per cent., however, germination is affected, and is prevented by quantities above ·8 per cent.; ·05 per cent. has an effect upon the growth of the plant, and ·20 per cent. produces stunted plants, ·6 to ·7 being enough to prevent their growth.

These results are tabulated below :—

EFFECT upon Germination and subsequent Growth of Maize of different percentages of injurious substances in the soil.

	Germination Affected.	Germination Prevented.	Growth Affected.	Growth Prevented.
Common Salt ...	·20	·50	·10	·25
Sodium Carbonate...	·20	·50	·10	·25
Ammonium Sulphocyanide ..	·005	Above ·02	·001	Above ·02
Sodium Chlorate ...	·004	Above ·006	·001	·004
Arsenious Acid ...	·50	Above ·80	·05	·60

Lessons of the Drought.

THE following reports from Inspectors of Stock, Inspectors of Conditional Purchases, District Lands Surveyors, Foresters and Managers of Departmental Farms have been received, in addition to the reports which were published in the issue of December, in response to an invitation extended to these Officers to furnish information on matters in connection with the late drought which may be useful in the future. Readers will, perhaps, appreciate the fact that almost without exception the officers who have been good enough to submit reports have, in the course of their daily duties which bring them into intimate touch with landholders of every class, had prolonged experience of the districts they write about—in many cases exceeding 25 years; and some of the officers are in a position to compare the conditions of the more remote districts as they are to-day with the conditions of nearly half a century ago:—

Cobar District.

MR. JAS. COTTON, Inspector of Stock, reports:—The year 1902 and the earlier part of 1903 will long be remembered by stock-owners as the culmination of a series of drought years, which eventuated in ruin and disaster to many who had hoped against hope, and bravely battled against the inevitable. Losses in stock were appalling, notwithstanding the numberless and expensive efforts put forth by owners, and the concessions granted by the Government in freight and carriage, to save the lives of stock.

A few owners who had the advantage of being near the railway fed thousands of sheep on chaff, hay, lucerne, oats, and even wheat, with more or less success. Experience proved that in most cases feeding was resorted to too late, when the sheep had not sufficient strength to digest the hard food, which simply hastened their death.

Most station owners had to rely on the natural edible trees, scrubs, and bushes of the district, which were chopped down by gangs of men specially employed for that purpose, and as drought succeeded drought great difficulty was experienced, inasmuch as the edible scrubs became cut out within a reasonable distance of the water and sheep were compelled to travel long distances for water and to feed, thus cutting up and destroying the country by constant traffic, leaving it a dust-bed to be blown away by high winds.

Edible trees and scrubs.—The edible trees, scrubs, and bushes, in their order of value, in this district are as follows, viz.:—1st, Kurrajong; 2nd, Mulga; 3rd, Warri or Currant Bush; 4th, Leopard Wood; 5th, Currawong; 6th, Emu Bush; 7th, Berrigan; 8th, Orange Bush.

Conservation and Propagation of the Edible Trees.

Kurrajong is certainly the best of our fodder-producing plants, its scarcity seems the reason why it is not more spoken of when edible plants are under discussion. As a drought-resisting tree it has no equal, and can be recognised anywhere by its luxuriant green foliage. Sheep, cattle, and even horses prefer kurrajong to mulga, warri, berrigan, emu bush, or any other fodder scrubs and do much better on it than any other, on account of its soft digestible nature. I am of opinion the reason why kurrajong is not more prevalent is

that stock devour it, even when grass is plentiful, in its first germination from seed, and every plant is killed in this way before it attains sufficient height to be out of reach. The seeds of the kurrajong are easily gathered and can be grown in boxes or in beds, like radishes, and when about the size of these vegetables are remarkably palatable esculents; in fact, they used to form a substantial part of the vegetable food of the aborigines in the early days before the country was stocked, and could then be found in great numbers underneath kurrajong trees. It seems apparent that something could be done in forming kurrajong plantations; seedlings could be raised in nurseries near large tanks or river frontages, or in the vicinity of artesian bores, and irrigated when necessary until they were sufficiently developed to transplant. The transplanting could be done after good rains, and the plant protected until it was out of reach of stock; and when once properly rooted, I am satisfied no drought could kill it. The vitality of the kurrajong is really wonderful; even in most droughty times lopping only seems to stimulate it into more vigorous growth, and the older the tree the more luxuriant seems the foliage both in quantity and quality. During tours of inspection in this district, it has been particularly noticeable that although pine, mulga, and many other trees and scrubs were dying from the effects of the prolonged drought, the kurrajong, wherever it occurred, was flourishing and appeared altogether unaffected by the extreme drought conditions which existed; even where it had been lopped vigorous shoots had been thrown out notwithstanding no rain had fallen since the lopping. It appears to me that in the kurrajong we have the acme of a drought-resisting, fodder-producing plant, which should be fostered, protected, and propagated. It flourishes alike on all kinds of country, from rocky sterile ridges to rich black-soil river frontages, and wherever it occurs on good alluvial flats the tree is always much larger and carries a wealth of beautiful green succulent foliage, which is as ornamental as it is valuable.

Mulga has astringent properties and is somewhat hard of digestion, but stock in strong healthy condition will not only do well but thrive and fatten on it. Stock-owners have to thank mulga for saving the lives of very many thousands of sheep, and from its prevalence everywhere in the district it has proved the most valuable fodder plant in this part of the State. Cattle seem to thrive particularly well on mulga, and even horses have existed on it through the drought. It is noticeable that no young mulgas seem to be growing to take the place of the trees which die or are cut down. Probably this is accounted for by stock eating the young plants and seedlings. Possibly something might be done towards protecting certain areas until the young plants have attained sufficient growth to be out of reach, otherwise, as mulga seems a short-lived tree, it may die out in course of years, and this valuable stand-by in times of drought become unavailable and extinct.

Warri or Currant Bush is not unlike lignum in appearance, but is rather lighter in colour. It has aromatic and tonic properties, and is consumed in large quantities by all kinds of stock. It has the advantages of being very prevalent, not easily killed, and throws out shoots of rapid growth after every good rain.

Leopard Wood is eaten greedily by sheep and cattle, and is a very valuable fodder plant where it occurs. It has proved of great assistance in saving the lives of stock, and the only faults which can be found with it are its scarcity and the fact that it is easily killed.

Currawong is generally found in the vicinity of mallee, and upon rocky ridges. It is a fairly good fodder plant for strong healthy stock, but is liable

to form felt balls in sheep, more especially where the digestion is impaired by poverty. However, it has rendered good assistance in saving stock during the late drought.

Emu Bush, a very valuable fodder plant, which I regret to say, is rapidly becoming extinct in this district. Rabbits seem to have a special liking for this bush, and in drought times eat the bark off as high as they can reach, thus ringbarking the plant, which speedily dies.

Berrigan or Rosebush.—A fairly good fodder plant which has rendered good assistance during the drought. It has the advantages of being very prevalent and almost indestructible, shooting again after each good rain no matter how mutilated.

Orange Bush comes next in the order of merit, but it does not occur in sufficient quantity and prevalence to be of much value, and it has a distinct disadvantage in being armed with hooked spikes, which tear out large quantities of wool from sheep feeding upon it.

The lessons taught by the drought in this district, I think, may be detailed as follows :—The necessity of conservation of more water. The subdivision of the land into much smaller paddocks than at present. The destruction of useless scrubs, and the ringing of useless timber. The careful and judicious stocking of runs, having at least one-third of each run unstocked, so that stock can always be removed when required, and before they damage the country. Also, the advisability of, where practicable, planting edible plants, scrubs, and trees, and the protection of same. The cultivation of wheat and lucerne for hay, in good seasons, and the careful storing of same, for use only in times of drought. And last but not least, the necessity of keeping the rabbit pest in check by some means.

Bourke District.

MR. D. W. F. HATTEN, Stock Inspector, Bourke, furnishes the following list of grasses indigenous to Bourke district, which appeared to be the most drought-resistant, and which were the first to appear after rain :—

Botanical Name.	Local Name.	Remarks.
Anthisteria avenacea	Oat grass	A good fodder
Anthisteria ciliata	Kangaroo	Rough and useful
Amphibranius nusii	Water	Good fodder, broad in leaf
Aristida calycina	No. 9	A very rough grass, eaten only while young
Stipa setacea	Spear grass or Corkscrew	A good grass, all stock will eat it
Neurachne mitchelliana	Mulga	One of our very best grasses
Andropogon sericeus	Blue	Good grass
Panicum effusum	Spider grass	Good fodder grass
Chloris truncata	Windmill or Star	Good fodder grass
Eleusine ægyptiaca	Small Crowfoot	Good winter grass, one of the best
Panicum gracile	Tufty grass	Not a good fodder
Pappophorum nigricans	Purple Top	Good feed
Amphipogon strictus	Black Top	A good grass
Eragrostis eriopoda	Never Fail	Not too good
Panicum leucophæum	Silver grass	Bad seed grass, practically of no value as a fodder
Aristida behriana	Wirey grass	Of little value
Erodium cygnorum	Crowfoot	Splendid winter herb
Cynodon dactylon	Couch grass	Fair grass, good while green
Panicum distachyon	Two-finger grass	Good feed, like an oat grass
Chloris ventricosa	Tall Star grass	A good grass

The above grasses are peculiar to the red country.

Wentworth District.

MR. D. A. MORGAN, Inspector of Stock, reports :—

The district of Wentworth contains an area of about six-and-a-half million acres, and is divided into 104 holdings, large and small. It seems a strange thing to say, but I consider the late drought and its troubles commenced with the phenomenal (for this district) fall of rain of eight inches, between the 10th and 29th of December of 1894, when it did little good but much mischief, so far as to beat down a lot of good dry grass, and to silt up a lot of tanks that were already full of water, also bring up a lot of useless herbage and wild melon. I do not for a moment say that melon is useless, as I consider it good feed, but this year it grew so very abundantly and strong that the vines, being very fibrous, caused the death of many horses through obstruction in the bowels. I sent a specimen to my department, and, as Mr. Veterinary-surgeon Stewart said, "nothing in the world would move such an obstruction." It was as hard as wood, and about the size of an ordinary man's leg at the calf. This was not an uncommon specimen.

At this time parasitic blindness amongst horses in the district was about at its height, and attacked the horses more or less on nearly every run. Many people attributed the blindness in horses to their eating the melons, but I do not think melons are ever the direct cause of blindness, although I dare say they are often a conveyer of the disease. And now, as I am about the blindness in horses, I might as well finish with it.

In support of melons being harmless, so far as blindness is concerned, at the time horses were contracting the disease daily in a dry lake paddock there was not a melon plant in the paddock. I spent two days collecting plants in that paddock (the 2nd and 3rd October, 1894) for the department, and there were only two plants that were pronounced injurious, and those were wild onion and tobacco plant—and horses do not eat much of those. There was an abundance of other herbage and grass of good quality, yet at that time, I will be bound, a horse would go blind in that paddock in ten days or a fortnight.

From the 18th to 29th of December, of 1894 I attended Mr. Veterinary-surgeon Scott in his investigation of the disease. Held *post mortems*, dissected several heads for him, preserving the brains and eyes in spirits; but the weather was intensely hot, and I think he only got one specimen to Sydney in fair condition.

During August, September, and October of 1895, under instructions from the Department of Mines and Agriculture, and directions of Mr. Veterinary-surgeon Stewart, I had two depôts, in one of which I had four horses under treatment, and in the other there were two. Both lots received vermifuge treatment. The four got five grains of arsenic once a week in addition to vermifuge powders, and two got turpentine and oil instead of the arsenic, otherwise the treatment was the same. These horses were quite blind by day and night. The horses that received the turpentine and oil recovered, and I think some of the others were better, but their sight was certainly not restored completely. Some years since, Mr. Superintendent Walker, of the Police, wrote to me of a police horse that was quite blind at Menindie, and I sent directions for the turpentine and oil, and a supply of powders. The horse received one month of careful treatment, and his sight was quite restored. This horse was quite blind by day and night, and is now still working as a troop horse. I feel sure this treatment is effectual if carefully administered, and the disease is not of long standing. I do not think it is of any use if the horse has been a long time blind. In fact, I am sure it is not, but I am quite as sure it is a certain cure if the subject is taken in time.

To return to the subject of drought, scrub cutting was resorted to in about June, 1895—but not on all the runs, and the owners began to feel in earnest the loss of the low scrub that the rabbits had destroyed. Although the district began the year with 628,000 sheep, they ended up with 575,000, and had sold very few. That year there was a decrease of 52,199 sheep, 316 horses, and 29 cattle. That was the first heavy loss, because, in the early days, before the rabbits had made such havoc with the scrub, the district never carried more than about 700,000 sheep in sufficiently good condition to grow wool. When speaking of scrub cutting, I mean chopping or breaking down edible bushes and trees of any sort that sheep will eat, and I assure you that there are very few that the merino sheep will not eat some of—for the merino sheep is truly a hardy animal. In my opinion, when scrub cutting is inevitable it is better to begin before the sheep get too low in condition, and while they are strong, and in robust health, and their digestive organs have not become weak, for really towards the end of this drought it was much like feeding sheep on pen-holders. Cut as great a variety as possible, and naturally near the water. Do not try and force the sheep. They will draw on to it themselves, and soon learn to know the sound of the axe. They have their own tastes, and like to choose the state in which to consume the scrub for themselves; but above all give them as great a variety as possible. There are several varieties of scrub that will hoove sheep.

During 1896 most of the owners had again to resort to scrub cutting nearly all the year, and finished up with 1,770 horses, 3,113 cattle, and 478,513 sheep, thus sustaining a loss of 122 horses, 110 cattle, and 97,319 sheep.

The January of that year was very hot, and ophthalmia broke out in several places amongst sheep and cattle. I recommended sulphate of zinc and sugar of lead, and where used the disease was soon stamped out. The Thursday, 23rd January of that year, was cruelly hot. It nearly broke all the thermometers in the district.

The year 1897 was another disastrous year. Of course, there was the usua expense of scrub cutting, and the season resulted in the shortage of 34 horses, 440 cattle, and 124,300 sheep, but a few thousand sheep were sent away to other districts.

1898 was not quite so bad, but there was little improvement, if any. There was a loss of 63 horses and 19 cattle, but an increase of 5,863 sheep. There were about 10,000 fresh sheep—one mob introduced, and one from another district. There was an outbreak of pleuro in a small herd, and I inoculated the cattle with preserved virus from Brisbane, but it did not take at all well. Generally things looked a little brighter.

The year 1899 began a little better than the previous years, but was very bad. Again many of the owners had to resort to scrub cutting. On the 16th June I inspected 80 horses that were very poor and weak and had to be travelled into another district for feed. But in the Wentworth district on a few runs things were more prosperous. One owner had a very good summer lambing out of about 7,000 ewes and saved them. This was about the most successful summer lambing I have seen in the district. I have seen several attempts, but they generally end in failure at weaning time.

The year's returns furnished 1,634 horses, 2,410 cattle, and 394,005 sheep, thus entailing a loss of 39 horses, 244 cattle, and an increase of 33,929 sheep; and there was a little traffic in sheep during the year to other districts, Victoria and South Australia, but not of much consequence.

The year 1900 looked very gloomy until about May or June, when on some runs there was a considerable spring of spinach and soft stuff, causing

a good many losses from hoove in sheep, and strangles was common amongst the young horses; and it turned out a bad season.

The returns of stock were as follows:—Horses 1,522, cattle 1,992, sheep 382,161—effecting a loss of 112 horses, 418 cattle, 11,844 sheep; but during this year there was some traffic in stock, but nothing of consequence, and of course there was the local consumption. Scrub cutting again became a considerable industry.

1901 turned out a bad year, but there was more traffic in stock. However, it resulted in a shortage on the year's transactions in live stock of 46 horses, 36 cattle, and 40,694 sheep. There was an outbreak of pleuro-pneumonia in the cattle, and I again inoculated with preserved virus from the Government Laboratory, Brisbane, but without satisfactory results. The outbreak was amongst workers, and whenever I was able to visit the station there was never a suitable subject from which to take the virus, but the preserved virus was used well within the prescribed time. There was also an outbreak of tuberculosis, but it was amongst introduced cattle from Victoria. I used the tuberculin test, and out of eleven the reaction in nine indicated disease, and those nine were destroyed.

Now comes the disastrous season of 1902. It commenced with 1,476 horses, 1,969 cattle, and 341,467 sheep, and returned 961 horses, 1,636 cattle, and 170,522 sheep, thus contracting a deficit of 515 horses, 333 cattle, and 170,945 sheep, and there was hardly any traffic in stock. Remarks here are unnecessary—the figures speak for themselves. Robust as the merino sheep is, mortal intestines cannot stand the wear and tear of timber for ever. Although the figures I have given you are as they were given to me, I believe them to be under the actual amount. I really do not believe there were 170,000 sheep in the district on the 31st December, 1902. One run that used to carry 70,000 sheep is now reduced to 5,000. Another that used to carry 35,000, now has 2,500.

However, a turn has come. When travelling around last week, where six months ago you could flog a flea with a whip, there is grass as high as the three-feet-six fences, and occasionally your horse nearly goes out of sight in bog and grass.

It is said that the Almighty helps those that help themselves, and things should never be as bad in the Wentworth district again as they have been. The railway to Mildura is now an accomplished fact, and trains are running. That is good. When it comes to Zelts, that will be better. But when it crosses the Murray into Wentworth, that will be superlative.

For the prosperity of Wentworth in the first place there must be some rain, and if there is rain something grows. There is no doubt the land in the Wentworth district is fattening country, and hitherto it has been an isolated area bounded on three sides by (for fat stock) an impassible desert, and to take stock northerly from here generally would be like taking coals to Newcastle. For store stock it is almost as bad, on account of the distances and expense—although probably fat sheep starting from here might arrive in a recognised market as fair stores, after a lot of expense—and so in the past owners have had to sit down and see their sheep when fat waste away and eventually die.

That is not so now! There is the railway from Mildura to the Victorian markets, and if owners do not take advantage of it it is their own fault. In ordinary seasons sheep can be held fat here till May, at any rate, and often later. May, June, and July are good fat sheep months in the Victorian markets. So now the Wentworth pastoralists will always be able to command a fair price for their fat sheep, and frequently they will be able to hold

them for the top of the market in July and August, and then spell their runs until they see a fair prospect of re-stocking. Sheep here, in my opinion, will generally hold their condition until the cold weather sets in, and will often be tip-top in the spring, but we must have some rain.

Until the railway crosses the Murray I will not say much about cattle, as anything like a mob cannot well be punted unless they are very quiet, and to swim a river like the Murray there is always a large amount of risk, but sheep can be punted without danger. Rabbits will still require constant attention. They attack the young growths of scrub which prove so helpful when other feed fails, and unless the scrubs have a chance to reproduce themselves they will die out completely.

Grasses.—I think now that the best grass that grows in this district is barley grass, and in the early days it was considered the most useless; but I think that when dry now it is the most nutritious dry grass. The seeds are bad for the horses' mouths and the eyes of the sheep. I think spear grass comes next in value, but when dry is not so nutritious; but very little rain in warm weather makes a green shoot at the butt, and then it is good feed. Silver grass is very good green feed, but of little use when dry. The lake and other water grasses are excellent feed during the warm weather, but as soon as the cold weather sets in they turn sour, and stock do no good on them. I think spear grass is the most drought-resisting of any, but for grass in this district it depends principally at what time of year the rain falls. Many old indigenous grasses, such as the blue grass that used to grow amongst the saltbush on the plains, have disappeared, and they used to be good feed at any stage, and would stand dry longer than any modern grasses.

Herbage.—There is a great variety of herbage in this district, and I think that beyond all doubt geranium is the best, and there are several varieties of it. It can hardly be called drought-resisting, as it will not grow in dry weather, but once it is there it is good feed at any stage or any condition. If it is blowing about on the ground for years stock will thrive on it. I know a holding in this district where the dry geranium kept the horses and bullocks in good condition for nearly three years. The owner was fortunate in getting a splash of rain just at the right time, and he had a wonderful growth of geranium just locally. Spinach grows very abundantly, but cannot be compared to other herbages, but, of course, is not without its value. However, when saying the best of it, it is very temporary. There is a great variety of wild carrots which are excellent feed, but certainly temporary. There are also many other kinds of herbage, all as a rule good feed, but not lasting in either a green or dry stage. I think the most drought-resisting herbage of all is the creeping saltbush, of which there are several kinds. If it once gets a start, very little moisture keeps it going all through the summer. It is useful in the extreme, and stock will often hold their own on it for a long time; yet I do not think it can be called a first-class fodder. The saltbush proper is becoming very scarce in the district unfortunately, and there is scarcely any need to comment on the drought-resisting qualities of that plant. I consider it certainly is the best.

Crops.—Wheat is about the only crop that is profitably grown in this district, and for all the awful drought we have passed through, there have been several very fair crops. Wheat seems to do on very little rain if it falls at the right time; but the crops of 1901 and 1902 were dreadful failures. Lucerne is grown in the district, but will not do without artificial watering, and it is only grown for green feed by those who have engines. My

experience of this district is for thirty-three years, and I have held the office of Stock Inspector just twenty years, and Acting Conditional Purchase Inspector for about thirteen years.

Inland Districts.

MR. W. H. TIETKINS, Inspector of Conditional Purchases, now stationed at Windsor but formerly engaged in various districts in the arid portion of the State, reports :—

Grasses.—There can be but little doubt that the most valuable of the indigenous grasses are the Mitchell grass and the blue grass, these however are only found in the northern parts of this State. I am not aware of any attempts having been made to introduce either of these grasses to Southern Riverina. Wrapped in its heat-resisting envelope of straw the young shoots of the Mitchell grass are specially protected from fierce weather influences. At Forbes and Condobolin districts the umbrella grass was observed to have wonderful powers of recuperation even under the most devastating circumstances. The trefoil clover sheds such abundance of seed as to literally cover the ground, and for months after the plant has been eaten or has been swept away by the scorching winds, stock of every description live and thrive on the seed in the prickly envelope that does so much damage to the wool, but which has saved the lives of thousands of stock. At Walgett during the drought I have tried repeatedly to grow Johnson grass giving it every care and attention, but without success. I incline to the opinion that indigenous grasses are best adapted to withstand protracted drought, for in small enclosures (in the drought country) such as cemeteries from which all stock have been rigidly excluded, there has been seen a strong growth of natural grass—"in the sere and yellow" of course, but an object lesson when viewing the surrounding desolation.

Forests.—Pine scrubs in certain positions on high ground have been observed to dwindle and die, presumably unable to continue under the withering heat and protracted dry weather. It has been observed that ring-barked timber was as generous with its sucker and other second growths as when dealt with in ordinary seasons ; this cannot be attributed to the injured tree not having sufficient strength left to send nutriment to its topmost foliage, for there was no difference in the foliage of trees not so mutilated.

Edible Trees.—"Myall" has been largely felled for its foliage, it is but a short-lived plant and with successive dry seasons will probably disappear as has the saltbush, the seedling shoot being devoured before it attains sufficient height to protect itself

Insect Pests.—Clouds upon clouds of grasshoppers darkened the sky and devoured every green thing that might possibly have been spared by stock. These were in much greater numbers than in ordinary seasons (the larvæ being destroyed by rain) ; it would appear then as if every product of the earth was doomed to destruction for a time—perhaps to rest.

Moree District.

MR. E. SCOTT, Inspector of Stock, reports :—One of the most striking features is the ease and quickness with which the native grasses and herbage have re-established themselves. It was thought and said by many keen observers during the severe drought of 1902, that it must take years for the grasses and herbs to re-establish themselves. This has proved to be a fallacy as regards this district. Within a few months of the termination of the drought, the district has been covered with a most abundant coat of herbage and grasses

of the most nutritious and fattening classes. The season, of course has been of the most favourable, but notwithstanding, the growth of herbage, etc., has been phenomenal. The oldest residents avow that they have never seen a better season. I myself have had a twenty years' experience of the district, and I do not remember ever observing such a phenomenal growth as we have had this year.

Drought-resisting Vegetation.—The most striking of these has undoubtedly been the "wild mustard." In many places in the district stock remained fat on this herb when all others had completely disappeared. The plain or spring grass stands the drought very well, but the mustard exceeds even this. Another drought-resister is the variegated thistle. This also proved a most valuable plant during the drought, stock remaining fat on it long after all else had disappeared and eating it down into the very ground. It is some years since we have had any great growth of grass—I think six years,—which has been due to the failure of the summer rains.

Herbages First to Come After Drought.—The most noticeable of these were lamb's tongue, and a herbage which was new to this district, and which ultimately proved to be of the saltbush tribe, and was identified as *Chenopodium atriplicinium.* This was the first plant to show on the black soil on the break-up of the drought. Then came the clover or trefoil, followed by, and simultaneously with, pigweed, crowfoot, South Australian clover, geranium or wild parsnip, and many others which I cannot name. The wild parsnip or geranium is one of the very best of our winter herbs, affording as it does a good bite to stock and then, when the top has disappeared, the sheep may be seen digging in the ground for the roots. I have seen acres of ground turned over in this way as effectually as if scarified.

There are few if any artificial grasses in this district. The prairie is most noticeable, and has firmly established itself in the bends of the Gwydir River and is a most valuable pasture. I would enumerate the following as drought resisters, in the sense of quickly responding to an adequate rainfall :—Spring grass many grasses of which I do not know the names,—Chenopodium, trefoil, milk thistle, crowfoot, geranium, &c. ; wild mustard, and variegated thistle above all others as standing feeding in the drought.

Conservation of Water.—Undoubtedly one of the main lessons of the drought is the necessity for an adequate supply of water. Artesian wells are undoubtedly the best means of conserving water. The artesian bores proved of the greatest possible service in this district, and many parts, or the greater part, of the district must have been deserted had it not been for the supply of water secured from these bores. Artesian bores, and more of them, are the solution of the water difficulty in this district.

Conservation of Fodder.—It is doubtful whether this can be grown or secured on a sufficiently large scale where large numbers of stock are concerned, but undoubtedly, and more especially with the aid of artesian water, sufficient could be grown and conserved to meet the requirements of stud and working stock for ordinary droughts.

Much has been said and written about conserving the natural growth, but this in practice does not pan out as well as in theory. One owner who has cut grass for hay whenever available informs me that he has always found it necessary to cut in a fresh place each year. One cutting seems to thin out the grass, and, by preventing it from seeding, seems to practically eradicate it, and the land must be spelled for several years before another cut can be taken from it. In seasons good enough to grow bush hay, artificial fodder can be grown, and inasmuch as it costs as much to gather the bush hay as it does the artificial, and the artificial growth returns ten or twelve fold more than the

natural, the artificial proves the cheaper in the long run. As illustrating the view taken by some pastoralists on this question, one of our largest and most successful pastoralists says: "My business is to grow stock, and I leave the business of growing fodder to those whose business it is who can do it better than I can; and when I want it I can buy it from them." This is one view. Another might be, if it was looked at in the light of an insurance, and a certain sum expended in growing fodder each year for the drought that is certain to come, it would prove beneficial to have it on hand. Conserve or buy when the fodder is cheap, as when most wanted, it is most in demand, and highest prices have to be paid. Very little has been done in the way of conserving fodder from natural herbage in this district. In a few instances hay has been made, and in others clover and variegated thistle have been experimented with in the way of making ensilage. To sum up lessons of the drought, I would say—

Avoid overstocking as far as possible.—The seasons are so uncertain that it is very difficult to strike the happy medium, and, with the best of judgment, man is prone to fall into errors. One of the best-managed and understocked runs in the district suffered from the drought to the extent of the purchase of nearly £20,000 worth of fodder in 1902. Conserve more water by artesian bores, and, ultimately aided by irrigation, this will aid in mitigating the effects of droughts.

I do not look upon the drought as an unmixed evil. As the long-continued sunshine has the effect of sweetening the earth and destroying parasites, after droughty seasons we have always healthy stock. After wet seasons we get diseases among the stock, which are fostered by the unhealthy conditions brought about by an excess of moisture.

MR. C. W. LAING, Surveyor, reports:—

Feeding Stock.—The recent drought was so general and protracted that it practically exhausted all ordinary means adopted in this district of coping with droughts, such as cutting edible scrubs, artificial feeding on hay, chaff, bran, molasses, and removal of stock to more favoured localities. Continuous feeding on fallen timber and scrub killed the stock eventually from indigestion; hand feeding on chaff and artificial fodder proved too expensive and the supply limited and impossible to maintain; removal of stock to more favoured localities resulted in those localities being so overstocked that it was only a temporary advantage.

Grasses and Edible Trees.—The most durable grass in this locality is blue grass; the most useful fodder trees are myall and belar.

Little attempt at irrigation was made in this district. Wheat was grown at Merriwa and sheep fed on it. Expensive machinery and pumping plant was required, and a practically inexhaustible supply of water, and the results appear to have been unsatisfactory as regards coping with the drought, although luxuriant crops have resulted from rain.

Water Conservation.—In many places stock had to be removed on account of insufficient water supply. Deeper tanks, with less surface exposed to the action of the wind and sun, and with one approach, would have secured a more permanent supply and resulted in less waste, and corduroy approaches would have prevented weak stock getting bogged.

Overstocking has done great mischief; the ground has been harrowed and cut up by continuous traffic of sheep through large paddocks; more grass has been trodden down than eaten; the surface soil has been loosened, the roots of the grass exposed; high winds have removed the surface soil; the best grasses have been eaten out. Numbers of stock-owners made no effort to reduce the number of stock or remove them until the opportunity passed.

Light soils benefited most by light falls of rains; loose black soils required heavy falls of rain, and developed the greatest growth of noxious weeds. The most beneficial rains fell late in autumn, resulting in a thick growth of herbage, which is now disappearing. There has been little or no grass except in the higher and colder parts of the district.

The extension of railway communication to outlying districts permitted forage and general supplies to be procured with promptness and minimum expense; secured speedy transit of starving stock to more favoured localities, far distant, when stock routes were impassable from want of water and grass, and stock too weak to travel; and stock could be detained until all resources had been exhausted. The necessity for the extension of railway communication to outlying districts is evident. Moderate stocking would secure greater immunity from loss; subdivision of holdings into smaller paddocks would prevent destruction of grasses, and stock would do better; better provision for water could be made by deeper tanks with less surface exposure; small enclosures might with advantage be made to graze large stock only, to give grasses an opportunity to seed and edible shrubs an opportunity to grow; and advantage should be taken of favourable seasons to harvest a fair area of natural grasses for consumption during drought.

Mr. A. Lockhart, Surveyor, reports:—During the drought of 1901-1902 the district I was employed in may be roughly defined as from Moree to Mungindi, Mungundi to Cumborah, Cumborah to Brewarrina, Brewarrina to Goangra, and Goangra to Moree.

Grasses.—In the district above-mentioned, grasses have not grown for some four years, and the whole pastoral industry has been dependent on (1st) the spring growth of herbage; (2nd) on feeding of scrub; (3rd) on artificial feeding, chiefly in the vicinity of railway lines. I may here state that grasses were never intended by Nature to be a stand-by through a drought in this district, in which originally grass was only supplementary to saltbush. The best of the grasses, such as Blue, Mitchell, and various members of the Panicum family, will not resist the prolonged dryness and constant eating down, now that there is no saltbush for stock to fall back on and give a chance for the grass to recover.

Herbage.—With moderate autumn and winter rains there is produced on this rich black soil an abundance of rich herbage of clover burr, crowsfoot, indigo, mustard, geranium or parsnip, wild carrot, sago or lambs' tongue, &c.; but most of these are very succulent, and their drought-resisting qualities poor. The three best are clover burr, mustard, and geranium. The clover burr is not much use as a fodder plant in itself, but produces an immense quantity of seed which is very fattening, and which stock are very fond of; but in licking up the seed, stock also lick up a large quantity of dirt which is responsible for many deaths. Mustard is valuable as being a herbage that stands drought well, and is one that stock will not eat while green. It therefore has an opportunity to seed, and is consequently in no danger of being eaten out. This shrub lasts well unless summer storms rot it at the root. The parsnip grows chiefly on rich chocolate soil, probably getting its name from the parsnip-like root which sheep scratch for and live on.

Edible Trees and Scrubs.—During the recent drought, almost all sorts of scrubs have been tried for feeding stock, such as myall, mulga, whitewood, boonery, belar, wilga, and rosewood, besides various of the eucalypts. All these scrubs, except belar, wilga, and rosewood are now so scarce as to be hardly worthy of consideration. Belar and wilga are considered the best fodder. Stock will eat rosewood that grows on chocolate soil, while refusing any that grows on red soil. The tendency of any of these scrubs is to bind

stock, and it was particularly noticeable during the recent drought that stock fed on scrub thrived much better if watered from bore water than if watered at tanks or rivers.

Water Conservation.—The question of water, which is such a vital one in this district, has practically been solved, as on the whole area artesian water can be obtained.

Conservation of Fodder.—If the lands of this district are to be at all safe in a drought for 50 per cent. of the stock carried in ordinary seasons, it will be necessary to conserve as ensilage some small proportion of the large amount of herbage that now annually goes to waste; and this can be done with the ordinary working teams, the total cost being about 2s. 9d. per ton. It would also be a great advantage if holders would cultivate and scatter seed of salt-bush, the drought-resisting qualities of which are well known. Much could also be done in the way of growing hay in favourable seasons in the vicinity of artesian wells by partial irrigation, though it remains to be proven how long one area of land would stand irrigation from bore water before becoming saturated with chemicals.

Stock.—The sheep that withstood the drought and the scrub feeding best were those carrying a comparatively light fleece; the finest wooled, best bred, and heaviest wool-carrying sheep being the first to succumb.

Forestry.—Nearly all the forest reserves in this district are for the preservation of pine, and in most of them the best of the pine has been killed, in some to such an extent as to render them quite useless for the purpose of forest reserves. A careful inspection of old-standing dead timber leads to the conclusion that the drought of 1888 affected the reserves in a similar manner, and the consequent belief that here at all events we can never look forward to having more timber than will meet the requirements of ordinary local consumption.

I have not touched on the subject of artificial feeding, as I do not know the cost of same for a large quantity of sheep; but from the many things tried, I fancy chaff and molasses mixed proved the best. For feeding working horses, I found chaff, corn, and pollard to be a better mixture than chaff and corn alone or with bran. By using pollard the corn was saved, and horses did more work and kept in better health than on anything else.

Warialda District.

Mr. H. C. Barrington, Inspector of Conditional Purchases, Grafton (late of Warialda):—As I only took up duty as an Inspector of Conditional Purchases at the beginning of the year, I am not in a position to offer any remarks so far as the coast district is concerned, seeing that the drought was over before my arrival, but I am in a position to furnish a few remarks as to drought experiences obtained in the *Warialda Land District*, Central Division, where I was employed as a licensed surveyor from 1891 to end of 1902.

Grasses.—In the Warialda district, embracing county Burnett and parts of counties of Stapylton and Arrawatta, so far as I know, no imported pasture grasses have been tried, and, from my experience on the coast, I do not think they are likely to succeed. Paspalum is the only one that might do, and I should imagine that on the alluvial river and creek bends it might succeed, but not in ordinary forest country or black soil plains. On the coast I have only seen it a success in the rich brush or forest brush lands. I have seen it tried in very many cases on the ordinary forest lands in the Grafton district, but in no case has it taken well. So far as the natural grasses in the Warialda district are concerned, I am not in a position to give a preference to any

particular kind; they all failed in 1902. I noticed in the winter of 1902 that stock of all kinds paid great attention to the trefoil burr, licking the burrs off the ground. Thistles, both variegated and black, were eaten down to the surface, and in many cases below it, the sheep scraping the earth away to get at the roots.

Edible Trees.—As to cutting timber for stock, so far as I can ascertain it was comparatively speaking a failure—here I refer to apple, box, belar and ironbark. After feeding on the leaves for a few months the stock begin to die, being unable to digest the woody parts of the leaves and small branches. On one large holding, where upwards of fifty men were employed for some months in felling timber, the owners informed me that if they had another drought to contend with they would not cut timber. The above remarks would not apply to kurrajong, wilga (some kinds), dogwood, and probably myall.

Prickly Pear.—This as a fodder plant is, I think, a failure. In the drought it was used a good deal, boiled and mixed with chaff, bran and pollard, the general opinion being that its nutritious qualities were almost nil. In dry weather the leaves become thin and wrinkled, and contain very little moisture. The spines are disposed of either by roasting or boiling, chiefly the latter. If fed in ordinary seasons, when the leaves are full of moisture, singeing would be the better mode. I have seen it reported that stock have been fattened on pear. I, for one, cannot believe this. If the leaf is eaten by stock in its natural state the spines will sooner or later kill them. I have noticed that in some parts there is a tendency to revert to wells in place of tanks or dams. Of course it is everywhere admitted that stock do better on spring or well water than on tanks or dams. Cattle, and to a less extent horses, pollute water a great deal, thus rendering it unfit for use before a tank or waterhole is half empty. On the coast I have been informed by different stock-owners that many cattle would have been saved if owners had taken the trouble to lift the water into troughs, instead of allowing the stock to walk into the holes, and the extra labour would have been amply repaid. In the Warialda district water is generally lifted by wind power, both from wells and dams.

In the recent drought I noticed that the black soil country suffered far more than the red or sandy soil; the roots of the grass in the black soil were in many places quite dead, and could be pulled up or kicked out with no trouble. After the rain came the red and sandy soil had sheep feed in a week, while the only response on the black soil were a few useless weeds.

In the Warialda district there is but little saltbush; it has been long since eaten out on the plains. I notice that in brigalow country after ringbarking saltbush appears to come up thickly, where prior to ringing there was little or none.

Growth of Seedlings in Coast District.—So far as the coast district is concerned, on all sides land-owners are agreed that the recent dry seasons have been very favourable to the growth of seedlings, and recently I have seen young plants coming up literally in hundreds, and not only in ringbarked country, but in that untouched by the axe.

Bland District.

MR. J. B. DONKIN, Lake Cowal, states:—I firmly believe in Mr. Russell's theory of nine years' periodical drought, viz., dry years when the moon is in her north declination. This drought ended in 1903. On all holdings an area of one-tenth should be conserved for time of drought, and also to allow natural grasses to seed. I have been carrying this plan out for some years with success.

Saltbush I find of no value; will not stand feeding. Thirty years ago you could not see a beast here for old man saltbush, now every leaf (except in my garden) has disappeared.

Barley grass and trefoil are the best two fodder plants, and last year one paddock of barley grass grown the previous spring kept all my rams in good condition. They will eat the dry stalk and lick up the seed when it is apparently almost rotting on the ground. Trefoil is still more nutritious, but is not so prolific as barley grass, and that is why I rank the barley grass first.

Seventy-five per cent. of the losses I attribute to overstocking. The country will not stand the pressure put on it. Two acres should be reserved for each sheep to be perfectly safe in the Bland district, which is similar to Riverina as a whole.

Careless Use of Fire.—This Act must be enforced with rigour. We are now threatened in this State with a conflagration which would do more harm in one day than the last two years' drought. It is perfectly safe now (16th November, 1903) to burn at night, not as the Act says from 7 a.m. to 9 p.m., and people must secure their paddocks by burning or clearing sufficient breaks.

Artificial feeding at the best is a bad job, and will never pay for a continuance; yet every holder should provide in good seasons a nucleus of fodder. I advise wheaten or lucerne hay (where it can be grown). This year I have harvested 50 tons of wheaten hay, the land producing 3 tons to the acre. Artificial feeding may tide over, say, three months, but beyond that it is not practicable. Sheep do not thrive even under the best arrangements. I found the Victorian compressed fodder (oats, bran, chaff, &c., compressed) to give the best results. I consider my plan of conserving natural grasses far more satisfactory.

Pure merino sheep (Riverina type, big carcass, free wool) thrive the best. I had 600 pure Lincolns and 15,000 crossbreds for some years, and have abandoned them. I could not make them pay at the then prices.

Water.—Sheep should not travel more than 1 mile to water. I found a 5,000-yard tank with troughing and windmill sufficient to supply water all through the late drought to all the stock that can water within its limitations of area. My own opinion is that with care not to overstock, and one-tenth in reserve there need be no fear of droughts in similar country to this.

I have been irrigating for nearly twenty years, and it is a valuable adjunct to grazing, but when water has to be artifically raised it will not pay to grow cereals to feed stock upon, except in absolutely abnormal times.

Stock fatten on old grass in this country if supplied with Liverpool salt, and in extreme times an additional lick of molasses.

It is a well-known fact that not one holding has made any profit for years, some have lost everything; now the drought is in a great measure responsible for this state of things, but I feel sure with greater judgment and care the effects of the drought may be minimised. It is not the drought that I am afraid of, it is the universal bed-rock level of values to which all raw productions have fallen to; for instance my wool for years has not averaged 6d.per lb. all the year round, and only a few years ago I sold 14,000 fat wethers—off shears—at 3s. 6d. per head. If value for wool and stock can be assured at the present values, all those living upon the soil will soon be on their feet again. For many years it has taken three sheep to produce in value what one will do now, and this is the secret of overstocking.

With regard to agriculture the same argument holds good as to prices &c., but not to overstocking. Nothing can be held in reserve here, and from thirty years experience in this district where the rainfall lowers to 8 inches in

one year, I cannot otherwise regard it in any other light than a mere gamble.

Within the saltbush area I fail to see that agriculture can ever be successful alone. I mean by the saltbush area that part of the State where at one time or other saltbush was indigenous.

Dubbo District.

MR. C. MARRIOTT, District Forester, reports:—

Effects of Drought upon Afforestation.—The late drought has been responsible for the destruction of numbers of pine, box, ironbark, and, in fact, all forest trees in the West, and as would be expected it has been particularly severe on timbers growing on rocky ridges and shallow soils. In some places the country looks as though the trees had been ringbarked. Not only timber generally, but fodder trees and scrub have likewise been disastrously effected, and, together with the serious treatment to which such edible trees and scrub is subject during drought by improper lopping, it will be some time before recovery takes place. During the dry seasons just past, large quantities of dead timber has fallen, and is now lying on the ground, a serious menace to future forestry prospects; for, with the almost unparalleled growth of grass and herbage which has taken place since the rainfall, in case of fires breaking out, it will intensify the calamity, and young and valuable timber may be destroyed.

Edible Trees.—Beyond doubt, numbers of the stock lately saved existed almost, if not entirely, in many places upon the native fodder trees and scrub. Kurragong, mulga, myall, whitewood, rosewood, oak and others have stood by the stock-owner in this district. The germination of seeds and growth of seedlings are specially noticeable after the drought, showing that Nature protects the seeds in a dormant state during periods like the past, and with a few good seasons natural afforestation will make vigorous headway. The necessity for strictly enforcing the regulations for the preservation and proper utilising of these fodder trees and scrub, cannot therefore be too strongly urged. There should be organised a system of clearing up forest reserves of dead timber. More direct attention should be given to the leaving of fire-belts of green timber when clearing timbered country.

Ringbarking.—Judicious ringbarking improves country: but in the past, serious destruction of good and valuable timber has taken place and the land denuded of even ordinary shade trees in many instances. There are very far-reaching results arising from too severely clearing timbered country by ring-barking. Forests undoubtedly check floods and store water in natural reservoirs. In times of drought, soakage wells are often found in timbered country. Dust storms are more frequent and more severe in the West than when there was more forest country, and owing to the surface of ringbarked country becoming hard and wind-swept in dry seasons, the rain when it falls does not penetrate to any depth, but quickly cuts fresh watercourses to the main stream, conveying sand and silting up the waterholes and creeks, which also in turn causes trouble right along to the mouth. Differences of opinion exist with regard to the proper method and times for ringbarking. It has been noticed that very successful ringbarking has been carried out during the drought, very few of the trees suckering in the absence of the ordinary sap.

Ringbarking should be carried out under proper supervision of the forester, and should not be allowed on high elevations, dividing ranges, or along the banks of rivers and creeks.

Matters where Agriculture and Forrestry Converge.—Land unfitted for occupation by settlers and agriculturists and possessing timber possibilities

should be constitutionally preserved for forestry purposes. In taking up land for agriculture due regard should be paid to the leaving of sufficient timber for shade, shelter, and other purposes generally.

The preservation and cultivation of fodder trees on any portion of land not adapted for agriculture might be urged with profit, as seasons similar to the ones just passed will most probably recur.

The number of rabbits should be kept down, as in the past drought many useful edible trees and scrub were destroyed by these rodents.

Forbes Land District.

MR. JOHN G. POSTLETHWAITE, Inspector of Conditional Purchases, reports:—
To my mind the most important course to take is to under-stock the land; this, with a supply of water, will tide stock over a drought even as severe as the one which is now happily at an end.

Crops.—In these dry districts—Grenfell, Barmedman, Temora, &c.—wheat and oats, if sown on fallowed land, well harrowed after ploughing in the spring, and before the early sowing in the autumn, will generally give a payable crop. Late sowing, except in very good seasons, is throwing money away.

Grasses.—As far as I could judge, all grasses went about the same time, except couch grass. If any, corkscrew was eaten first, and thus it may be considered one of the favourite foods. Crowsfoot and barley grass are more in evidence this year than I have formerly noticed.

The grasses first to appear after the drought were barley and crowsfoot, followed by trefoil, corkscrew, &c., and some grasses and weeds I had not seen previously.

The variegated thistle is a most valuable fodder and should be encouraged. Even the despised star thistle was eaten last year by stock, but I cannot recommend its cultivation.

The best crops grow on fallowed land, or land that has only been twice cultivated. Ploughing 4 or 5 inches deep is as good as 7 inches in ordinary soils.

Conservation of Fodder.—Where most of us are making a mistake is in not mowing and making hay or ensilage of the grass now going to waste. Want of foresight and too large holdings are the cause of this error. If the land is cleared of fallen timber, sufficient grass could be cut and stacked to feed, say, one sheep to the acre for six months, even without other food; or, if wheat can be grown, cut and thresh the wheat and stack the straw, in which way you conserve fodder, and fodder that will keep.

Sheep do well on lucerne hay or corn or both together. Say, $\frac{3}{4}$ lb. of lucerne and $\frac{1}{4}$ lb. of corn daily. For old sheep, hay with molasses.

Guarding Haystacks from Mice.—I am of opinion the most practical way of meeting the drought in dry districts, where irrigation is not possible, is to grow wheaten hay, well salt it in the stack, and stack it away from water, so that arsenical water may be used for mice.

Edible Trees.—The various scrubs used as fodder, in order of merit, are kurrajong, wilga, boree, sheoak, belar, dogwood, warrior bush, bull-oak, and currawong. Stringybark and box tree leaves (not bumbil box) are also eaten by stock; but feeding on scrub of any kind, except kurrajong and wilga, is a most unsatisfactory way of keeping stock alive. In all cases when scrub is resorted to, the stock must have abundance of salt and a good supply of water.

Stock.—I did not notice that any one particular breed of stock stood the drought better than another. All suffered severely.

Mr. E. B. Barton, Inspector of Conditional Purchases, reports :—I have not been in this district long enough to give an opinion on it. My experience for the last thirty years has been in the Western District, where agriculture is almost unknown, except with irrigation.

Grasses.—The best and most durable grasses here are blue, star, mulga and couch grass, the latter on flooded country. Many other grasses grow up very quickly after rain.

Stock.—I found that the Devon and Alderney cattle kept their condition much longer than most other cattle and stood travelling better; and in sheep, the ordinary merino was the first to give in. All crossbred sheep, "long wool," stood the drought much better than the others; and with horses I found that the Suffolk Punch is the best doer during hard times; and with light horses, the half-bred pony will stand more hardship than any other horse doing the same work.

Mr. J. S. M. Benson, Surveyor, reports :—

Grasses.—In the parts of the State over which my duties have taken me during the last few years, I have not seen any grass which might be called drought-resisting. It is remarkable how quickly the grasses have been rehabilitated; they disappeared simultaneously and all responded rapidly to seasonable rainfalls. The germs of natural grasses it would seem are indestructible.

Edible Scrubs.—There are no fodder plants in this neighbourhood unless edible scrub is included in the category of fodder plants. Wilga, myall, kurrajong, sheoak, emu-bush, warrior, berrigan, belah, and currawong have been most in demand, but as no stock within my knowledge have been fed exclusively on any of the above-mentioned, I am unable to say which of them proved of greatest value.

Ringbarking.—With respect to ringing and scrubbing, I have noticed that operations carried out during the drought have been more effective than they otherwise would have been in ordinary seasons; and it would seem that the strength and density of aftergrowths depends a great deal on the season immediately preceding and the season following the work—apparently to a greater extent than on the particular method of treatment. It has also come within my notice, that in parts of the district where the soil has been comparatively shallow, a large quantity of pine scrub, currawong and "mountain" gum has died, and these are the only kinds of timbered growths which appeared to have suffered to an appreciable extent by the dry weather.

Stock.—With respect to stock, I observed that the medium-sized animal in all cases fared best.

The mortality among marsupials has been very considerable; in fact, the drought has practically exterminated them in places.

Mr. F. J. E. Bootle, Surveyor, reports :—

Grasses.—The country has been so bare of grass and herbage during the last two years of the drought, where I have been employed in the Forbes and Condobolin districts, that I have not had many opportunities of studying which are the most drought-resisting kinds.

The trefoil has proved itself in drought time to be one of the best of our natural fodder plants; it grows in the cooler months of the year, and is excellent for fattening after it has died down. The dry hot weather does

not take away its good qualities to any extent, and there is the great advantage about it that it dies down before Summer comes on, and does not prevent the ordinary summer grasses from growing. In the winter and spring of 1901 the barley grass and trefoil made some growth, but as soon as the hot weather came the barley grass became practically useless, while, wherever the trefoil had been growing, the seeds of it, lying on the ground, kept the stock in good condition for months after every vestige of grass had otherwise disappeared. The seed of this plant should, therefore, in my opinion, be distributed over country where it is not already growing to assist in tiding over dry times.

Edible Trees.—The Winter and Spring of 1902 were so dry that nothing in the way of fodder plants would grow, and in many instances there were no edible trees or shrubs left, such as kurrajong, belar, myall, wilga, berrigan, warrior bush, salt-bush, cotton-bush, &c., that could be cut down or lopped for this purpose. Among these, the leaves of the old and matured belah trees were found to be by far the best for sheep feeding, except, perhaps, the kurrajong, berrigan, and myall, of which kinds there were not nearly sufficient for the purpose. Belar forest, when killed, is recognised as the best land for grazing, and consequently there is a tendency to kill off this timber and not save it for times of drought, which appears to me to be a great mistake, and that for the future as much as possible of this timber should be preserved.

Conservation of Fodder and Water.—The great lesson the drought has taught is the necessity for the conservation of water and forage in good seasons, so as to mitigate the severity of the droughts as much as possible. In good seasons, immense quantities of hay could be grown and a large quantity of water could be conserved by means of tanks, dams, and weirs, so that in dry seasons a certain amount of irrigation could be carried on to provide food for stock, such as lucerne and sorghum, which, so far as I have seen, have given the best results.

Mr. E. J. Halliday, District Surveyor, in submitting the reports of staff surveyors on the Forbes District, states:—Another lesson of the drought which it may not be out of place to mention here, is that where the rainfall exceeded 18 inches per annum in this part of the Central Division, the use of arable land for wheat-growing, when within, say, 15 miles of the railway, proved more profitable than the use of such land for grazing

Riverina District.

Mr. J. Rochfort, Inspector of Stock, Jerilderie, reports:—

During last year, the last of a series of dry years beginning in 1895 and ending with the present season, 1903, the year 1900 being passably "fair"; the great drought culminated in what appears to be by far the driest season ever experienced since the white man first settled in this part of Australia. I am led to this conclusion by the fact that all comparisons, as the drought progressed, were made with the year 1876-7.

I have a distinct personal recollection of '76-7, being at the time not more than 100 miles by road from Jerilderie, and engaged in pastoral pursuits. 1875 was the best season I can call to mind, and followed one or two excellent years. Feed could not possibly be so scarce as it was last year without one or two droughty years preceding.

Crops.—Taking 1902 as a basis, it is impossible to say what crops flourished best here, as none of them grew at all in the spring time. What few of the farmers got enough hay or seed wheat were indebted rather to the chance of a lucky shower than the choice or variety of crop planted. It is worthy of note that one or two of them sowed sorghum on the "off chance." This struggled on, just visible as a miserable blue leaf until the fine December rains, after which it flourished to an extent that amply repaid the grower.

Sorghum as a Chance Crop in Dry Seasons.

Would it be considered worthy of comment that a few acres of these late crops might always be worthy of a trial where the spring indicated failure of the ordinary cereals? I understand that the variety that succeeded best was *Sorghum saccharatum.* [In the *Agricultural Gazette* for February 1903, Mr. A. G. Humby of Narandera, writing from a ten years' experience of sorghum growing in a dry climate, recommended *Sorghum saccharatum* as the variety requiring least moisture.—Ed.]

It certainly did better in a small plot in my garden than Early Amber cane has done hitherto. In particularly favourable loamy soils like the forest country in the south-east of this district, Rape (principally Dwarf Essex) did fairly well up to last year. Lucerne where not watered in many places died out, or what little fodder it furnished was useless.

Grasses.—The Native Grasses lived through the season, as evidenced by the fine show we have now, but were very little in evidence. As a provision for the dry times, pre-eminently at head of all others stands Trefoil. One small patch of mine which had been lightly stocked for three years previously, fed a beast to the acre (2 year old cattle), for three months entirely on trefoil burr—and they held their own. Trefoil has another advantage, in that if a bush fire passes over the land, the outside "burr" of the seed is singed off, but without there is a great quantity of other material on the ground, the seed itself is rarely destroyed, and stock do better than ever on the singed seed pods.

The only native plants that can be said to have provided any green fodder were the shrub saltbushes, *Artiplex nummularia* and *Rhagodia hastata*, and the Boree.

Both the saltbushes are indigenous to this part of the State, which was probably once covered with them. They are now confined to one or two horse paddocks.

Boree undoubtedly kept more stock alive here last year than all other plants together, imported hand-feeding apart. Saltbush, if judiciously fed to sheep or cattle, would flourish. Where cattle or horses are turned on to it it exists—and grows—but sheep kill it outright. The reason of this is that sheep skin off every leaf they can reach; the stem is exceedingly brittle, and, all the undergrowth being eaten off, the plant has a dense mass of foliage which renders it top-heavy to such an extent that the first heavy wind breaks the brittle stem; the sheep then finish every leaf and the saltbush is asphixiated.

Whilst good grass is plentiful stock will only nibble, not feed, on saltbush, which increases its value as a standby.

The boree has suffered very considerably by the treatment to which it has been subjected, quite a considerable percentage of the trees being killed. A silk-weaving grub (I can get specimens if required) is also devastating huge areas.

Saltbush does not appear to be troubled with natural enemies of the insect kind. If so, I have been unable to discover them.

The Kurrajong, *Sterculia diversifolia*, is not now growing in a native state in this district. Where planted and a reasonable amount of attention given it at the start it does well. As a fodder it is superior to boree, and would, in picked spots, amply repay any trouble occasioned by giving it a start. Apart from an economical point of view it is highly ornamental and one of the very best shade trees for this climate. Though rather slow growing the trees in the streets of the town have almost doubled in size since the drought set in. The little water they get from drains is more than offset by the knocking about they otherwise get.

The saltbushes mentioned, boree and kurrajong, can all be easily grown here, and as a reserve fund for times of dire need are beyond comparison with any other plants with which I am acquainted.

Tagosaste is growing in picked places. In times of real stress it requires water; one wants to be careful not to give it too much. Where it was left to itself it did not give out a leaf—in fact, as a fodder plant it is now regarded as a confirmed fraud.

Wagga Land District.

MR. H. W. GRAEME, Staff Surveyor, Wagga, reports:—Owing to the protracted drought and heavy winds clearing the surface of the earth of nearly every vestige of grass, settlers took a very gloomy view of the lengthened period necessary for the country to supply its normal amount of native fodder after the termination of the drought. It is pleasing to note that within six months of that time the supply of native fodder is enormous, many old settlers stating that it is the best season they have known.

Grasses.—The grasses which appear to have most quickly and abundantly rehabilitated themselves are barley, corkscrew, crowsfoot, and clover: the barley grass appearing to have withstood the drought best.

Crops.—This drought has practically fallowed the soil, and I am of opinion that for our western lands, drought periods are Nature's methods for recuperating the soil. Crops are everywhere promising abundant yields; a prospective average yield from lands under cultivation in the district lying between Corowa, Gundagai, Young, and Narrandera is 16 bushels per acre.

Feeding Stock.—Among the cheapest methods of feeding stock for subsistence (not working) was that of cutting up straw and saturating it with watered molasses, and feeding from large troughs.

Water Conservation.—The necessity is now emphasised for providing adequate water supplies for ordinary selections, at least 2,000 cubic yard reservoirs per 640 acres being required.

Timber.—About 5 per cent. of the pine nurseries have been affected by the drought, the saplings dying either directly from want of moisture or not being strong enough to resist the frosts. There will soon be danger to pine nurseries, recently thinned by the Crown, from bush fires as the grass therein is from 12 to 15 inches high. There is apparently no destruction to semi-matured or matured timber; all that is now noticeable is an abundant growth of fresh foliage.

MR. W. H. LEE, Surveyor, reports:—In those parts of the Wagga district through which I travelled during the recent drought, all kinds of grasses and fodder plants equally failed and the country was completely bare of vegetation. The plain country was the first to suffer, the grass in the hill country lasting much longer owing partly to the fact that more rain fell there, and partly to the fact that the hill grasses are hardier, while the soil does not cake so easily, there being more sand mixed with the clay.

The worst kind of grass, which I know, is known as barley grass, and during the last few years the whole country has become overrun with it. This grass grows very quickly and is very nutritious in the early spring, but it seeds very early and dries into straw with the first hot weather. When this grass is dry there is no nourishment in it and it is useless for feeding purposes. I notice that this season there is nothing like the same amount of barley grass, and its place seems, to a great extent, to be taken by other and better kinds of grasses and herbage.

During the drought all methods of hand feeding stock by purchasing fodder at the prices then ruling proved ruinous in expense. The true lesson to be learned from the drought is the necessity for irrigation on the plain country, which is naturally suitable for the purpose; and in other places the necessity for the storage of ensilage and hay during the good seasons. In a season like the present one, large quantities of ensilage could be stored, almost everywhere, at a cheap rate, and if this were done systematically, during the good seasons, a sufficient supply of fodder could be stored to tide over a succession of dry seasons without loss of stock, and the expense incurred would in the long run prove amply remunerative. Also in farming districts the present method of stripping the wheat and burning off the straw should be abandoned as far as possible. In the case of good crops, the loss of grain by this method of harvesting is very large, and would go a long way towards meeting the extra cost of harvesting by means of the reaper and binder, while the stacks of straw obtained by the latter method would prove very valuable as a stand-by during a drought. Many farmers have told me that they intend saving their straw to a large extent in the future, but it is to be feared that the majority, trusting to a succession of good seasons, will put off incurring the expenditure in providing against a return of dry seasons until too late. It is to be hoped that the Department of Agriculture will put forward, by all means in its power, the necessity for insuring against drought, in a variable climate like New South Wales, by storing up fodder during the good years to tide over the bad ones. I am convinced that by this method alone, combined with irrigation, can a repetition of the disastrous losses in stock during the past few years be avoided.

Deniliquin District.

MR. O. WILSHIRE, District Forester, reports:—

Effects of Ringbarking.—Having been resident in this district for nearly 26 years, I believe that the ringbarking and felling of timber accounts to some extent for the decrease in the rainfall. During the past 25 years a large area of country has been ringbarked, in fact, most of the country, with the exception of Crown Reserves, as landholders, with no thought for the effect on the rainfall in the future, desired the greatest benefit from the grazing at the time. All freeholds have been seriously affected in this way, and also the Crown lands which have been alienated as homestead selections and settlement leases.

Rainfall and Forests.—The heaviest rain almost invariably occurs over the green timbered country along the Murray river, and it is in my opinion the absence of timber in other parts which makes their annual rainfall less. It is a very noticeable feature of ringbarking that when it has been carried out right up to watercourses they do not hold water for the same length of time as before. After rain any water caught in these creeks fast disappears owing to the greater evaporation and the large cracks made in the soil by the sun. It cannot be denied that ringbarking does improve the carrying capacity when rain does fall, but unless further restrictions are enforced in

the conditions attached to homestead selections and settlement leases, the greater part of the country will become a wind-swept plain. It would be of great advantage if belts of green timber had been left, or planted when possible, not only as firebreaks in good seasons, but also as a barrier to the wind. During the past year, through the severe drought and serious wind storms that prevailed, the soil was blown away from the roots of the trees exposing them to the sun; and the want of moisture caused thousands of pine trees, and even box and gum, in all stages of growth to die. A judicious planting of hardy and fast growing trees, *e.g.*, the sugar gum, in the sparsely timbered country would go a long way to mitigate this evil. Old Man Saltbush is an excellent barrier against wind, but landholders have a great dislike to planting it along their fences, owing to the harbor it makes for rabbits. The green timber generally shows the want of a flood, which would not only cover the roots, but also close up the cracks in the ground and bind the soil. The young timber especially has suffered during the last few years, and there is a great falling off in quality and quantity of new growth.

Corowa District.

MR. ALEX. CAMPBELL, Inspector of Stock, Corowa, reports :—So far as the Corowa district is concerned, no one grass in particular stood the drought better than another, except in the case of barley grass, which was with us almost all through, but was of no use whatever to stock. During the early part of the drought trefoil, (which is very plentiful here in good seasons), was a great stand-by, but during the last part, owing to the want of spring rains, the supply was not replenished.

There is also a thistle, known by some as the Californian (but which appears to me to be a mixture of the variegated or Scotch thistle, and the milk or sow thistle), which is good fodder for stock, and is now very plentiful; but it failed as did the trefoil during the drought.

Lucerne is the only artificial fodder grown in the district, and after the December rains, at the end of the drought, proved of great value.

Stubble paddocks were also a great stand-by, and large amounts were paid by sheep-owners for the grazing rights to them.

In a district such as this, so well adapted for growing large areas of lucerne in good season, the losses in stock should be very small if it was more extensively cultivated, and harvested for use in times of drought, but as a rule it is only used for grazing purposes, about 4 lb. of seed being sown to the acre.

Marratin District.

MR. BISHOP LYNE, District Forester, reports :—

Timber.—During the late severe drought Cypress pine suffered severely in many parts of this district; generally the timber was sapling growth, from ten to twenty feet high. The dying away was chiefly observable where the growth was dense, and at the present time I could show acres where a reasonable thinning out had been made through the timber dying as described. In nearly all parts of this district young box and ironbark saplings suffered severely, but in most cases did not die right out, and are gradually becoming vigorous again. In some places the matured trees over acres of land died completely.

Ringbarking.—There is a matter of importance which with this opportunity, I wish to bring under your notice. Throughout this district there are occasionally large areas of dense brigalow country ; the soil is productive, but the growth is of such a tenacious character that after ringbarking or felling the forest thousands of suckers grow up, with the result that settlers are afraid to, in the usual way, occupy the land. During the late drought the Railway Construction Department cleared the usual breadth for the line which they built from here to Wee Waa through some two or three miles of pure brigalow forest. The brigalow was usually cut by them at a height of two feet from the ground, and although this work was done about two years ago, up to the present I may say it is impossible to find a second growth of any kind, and stumps appear to be dead. It may be that felling at a particular time of the year had to do with the result, or possibly altogether climatic influences. A thorough inquiry may elicit information which would prove a great value towards utilising these large tracts of brigalow country.

Bathurst District.

MR. G. SIDNEY SMITH, Inspector of Stock, reports :—The Bathurst district, although badly affected by the late drought extending over so many years, suffered less than many other districts from that cause, and in many cases land that in ordinary times is or was considered almost useless was taken up and occupied by graziers from other districts for the purpose of helping to save stock—sheep especially—from complete destruction. Many holders having country partly stocked, or unstocked, let their holdings at a remunerative rate of rental to persons requiring runs for the purpose of saving their stock—sheep. Although in many instances these did not thrive, but lost condition, they were enabled to save their lives with a percentage of loss much less than would have taken place had they been kept on their original run, as well as saving the expense that would have been entailed by the carriage and purchase of feed. Many of the holders here kept their stock alive by felling timber for them to feed upon, and informed me that the better class was not from young trees, many cutting box, some stringybark (not old trees) and others oak, just as the country produced, also kurrajong, where obtainable. The better way to do with the latter is either to lop the leaves or lop the branches ; by these means you avoid destroying the tree. A great amount of fodder, in the shape of lucerne hay and oaten and wheaten hay and straw chaff, was taken from this district to other places for stock feeding. There were not many cattle or horses brought here for grass, but what few there were suffered little or no loss. The spring of last year, viz., 1901 and 1902, opened favourably, but went off, leaving very little grass after December, there being mostly herbage at that time. The present spring has given a great deal of herbage, such as trefoil and foxtail (called by some barley grass), and a great deal has been cut for the purpose of making ensilage, chiefly in stacks. One large landholder contemplated being able to put together from 400 to 500 tons for the purpose of winter feed, chiefly for dairy stock. This foxtail is almost useless when once the seed ripens, giving animals sore mouths, consequently is only fit for putting together for fodder in a green state, being useless as hay for the reason before stated, but when cut with trefoil and crowsfoot, should make excellent ensilage. Of all grasses sown in this district lucerne is acknowledged to be the best when on suitable land ; perennial rye, cocksfoot and timothy on cold bottoms. Prairie has not been considered a success, as it is soon destroyed if stock are allowed to graze on it. Paspalum is little known, and it appears as if it would take

considerable time and expense to establish a field here of sufficient size to be able to give a definite opinion of its merits or otherwise. Of other grasses I am unable to give an opinion, many that were tried utterly failed owing to the unfavourable season.

Orange Land District.

MR. R. DEIGHTON, Inspector of Conditional Purchases, Bathurst, reports:—

Class of Country which resisted Drought longest.—The country which suffered most from drought within the boundaries of my districts was that which under moderate conditions of seasons is the best. I allude to the white box country, where for the most part the red and chocolate soil is of a porous nature. This country, when the timber is killed, is very favourite grazing for sheep, and they will not leave it while a vestige of grass remains, hence the overstocking in such country. In the poorer lands such as are met with in the higher latitudes and colder climates, overstocking was not the case, and the herbage and grasses, generally inferior and rough, afforded feed to thousands of sheep especially, and kept them in fairly good condition, and in this class of country the water supply generally held out.

Forests.—With regard to the effect of the drought upon afforestation, I did not notice that where good and useful forests exist any marked ill-effects. In some parts, generally on barren hills where a poor kind of stunted forest grows, many trees appeared to die from drought effects.

Effects of Ringbarking.—With regard to ringbarking, if in the past a proper system had been adopted instead of the wholesale destruction of timber, I believe the drought would have been less severely felt, and I did notice in some ringbarked areas where shade clumps and a percentage of green trees to the acre had been conserved, that the grazing was appreciably better than in the country quite denuded of timber.

Conservation of Fodder.—With regard to provision being made for future droughts, I am convinced that grass and herbage, which grows so abundantly in some parts of the State when good seasons set in, can be conserved in great quantities at a moderate cost, and I know that it was done in the drought of 1888-1889 with very beneficial results.

Water Conservation.—There is also much need of a better system of water conservation, chiefly by the construction of larger and deeper tanks, which ought to be permanently fenced off from the stock, leaving, of course, gates of access when necessary, and in the case of very large tanks, such as 10,000 cubic yards and upwards, water lilies might be grown to check the evaporation. This has, I believe, been done in some other States with advantage.

MR. S. SIM, jun., Inspector of Conditional Purchases, Capertee, reports:—

Grasses.—So far as my experience is concerned, I am of opinion that the grass that best withstands dry weather is what is mostly known as kangaroo grass or wild oats, a summer grass with good fattening qualities. The frost somewhat cuts the flag, but it is always good feed. Of other grasses I am practically ignorant so far as the names go, but the grass mentioned grows and thrives in the hot as well as cooler climates, and if not overstocked, grows well and covers the ground.

Forests.—I do not know of the drought having affected the forest at all where there was plenty of soil or even a decent depth, even stony, but patches of stunted timber having no value have died right out in parts of the district. Such patches are confined to the summits of very sharp rocky

ridges or where the rock is just under the surface. Such areas are very small, and hardly worthy of notice. The forest generally has not suffered in this district.

Armidale Sheep District.

MR. CHAS. J. VYNER, Inspector of Stock, Armidale, reports:—Comparatively speaking, this district did not suffer very heavy loss of stock, although some owners, particularly on the western slopes of New England, were heavy losers; but, in addition to pulling through with a comparatively small loss of stock, this district supported thousands of stock from more droughty districts.

Crops.—The crops were either nil or very light, but those who harvested light crops got a very good price for them, while those whose crops failed or were not long enough to cut were heavy losers. Over the greater part of this district the only crops cut were for hay. Very few crops of maize yielded any corn, most of them being cut for fodder.

English grasses made little or no growth during the drought, and in places entirely disappeared, reappearing patchily since the rains, except in the moister parts of the district, where they seem to have suffered very slightly. There is abundance of grass now with the appearance of storksbill, crowfoot (?), variegated thistle, and many other herbs which were either rare or unknown here before the drought; although since the drought broke there has been abundance of rain, there is very little white clover.

Noxious plants, such as blackberry and briar, seem to have grown just as well through the drought as in a wet season.

Edible Trees.—The wholesale ring-barking of certain areas has been proved by the late drought to be a mistake. Sheep and cattle did well for a time on apple, white box, river oak, and drooping gum, but, in addition to these edible leaves, a certain amount of grass picking or artificial feed was necessary, as after a time on little else than leaves the sheep failed rapidly.

Want of water was a considerable difficulty. On many runs the stock were forced into the frontage paddocks for want of water in the back paddocks. This has led to the establishment of several pumping plants, the sinking of wells, and making of dams, which will obviate the same difficulties should another drought occur.

Feeding pure grain to sheep was a mistake where the sheep had not enough picking to mix with the grain in the rumen to enable the sheep to regurgitate for rumination, the grain being found caked in the rumen after death. Owners who fed long hay out of the tail of a cart had fewest losses. There is absolutely no waste in this way of feeding, being more economical than chaff feeding, and sheep did better on it, particularly if they got after it a little broadcast maize.

The last drought has been less disastrous to sheep in this district than the same number of years of wet seasons would have been. In the latter case the mortality would probably have been heavier, and in the former the stock which came through were thoroughly healthy and sound, internal parasites being practically absent. The deaths in cattle were mainly in old cows and breeders, and in horses it was only the old ones which died.

Glen Innes, Inverell, and Tenterfield Districts.

MR. J. B. WISDOM, Inspector of Conditional Purchases, reports:—The districts over which I exercise supervision as Inspector of Conditional Purchases are—Glen Innes, Inverell, and Tenterfield. These districts,

although having suffered to some extent from the recent dry seasons, were not affected in the same degree as other parts of the State. The districts of Glen Innes and Tenterfield being practically table-land country, and, as a rule, generally well-grassed, carried, in addition to locally-owned stock, a very considerable number of sheep and cattle from the dry Western districts during the years 1901–2–3, and consequently the natural grasses were fed down to such an extent that by the end of the summer of 1903 they were eaten very bare. The district of Inverell, on the Western slopes, carried very little outside stock except that belonging to local owners. Before the very dry weather set in, at the beginning of the winter of 1902, and continuing pretty well up to the end of the summer of 1903, these districts were well supplied with natural and artificial grasses of all descriptions; but there is not the slightest doubt that over-stocking was the principal cause of the losses of stock throughout them. Otherwise, there would have been sufficient feed to have carried anything like a reasonable number of sheep and cattle. A few lightly-stocked properties were sufficiently well grassed during the drought.

Grasses.—As far as my experience and observation goes, I noticed that the artificial grasses which stood the effect of the drought best were perennial rye and lucerne. The durability of the natural grasses —the coarser ones especially—was remarkable, and the roots must have a strong hold, as they are now showing no bad effect from the drought. Paspalum has been tried in these districts, but so far has not proved a success; the climate, apparently, is not sufficiently warm and humid enough to assist the growth. There is not the least doubt that a careful growing of artificial grasses (rye and lucerne especially) would materially stand to stock should unfavorable seasons recur, as those particular kinds appear to have stood the drought and over-stocking best. At the present time, after the favourable spring weather, the growth of natural and artificial grasses and herbage in these districts is phenomenal, and all of them have revived better than ever.

MR. J. ST. CLAIR, Inspector of Stock, furnishes the following list of grasses and fodders:—

Best native grasses found to resist the drought.—Owners report the following, viz.:—"Eragrostis pilosa," a dark-green tussocky grass. Couch grass, cocksfoot, kangaroo.

Fodder Plants.—Kurrajong, the narrow-leafed apple, river oak, and tea-tree scrub; also sheep eat eagerly the berries thrashed from the sweet briars.

Artificial Grasses.—Prairie grass, sheep's burnet, Kentucky blue, Poverty Bay, red clover, lucerne, were found the best. Paspalum was tried in a few cases but without success, the climate being too dry.

Artificial Feed.—The following were tried with fairly good results, viz.:—Oaten hay and chaff, chaff and molasses, lucerne hay, oaten hay and molasses, maize ensilage, wheaten chaff, steamed wheat and maize spread broadcast on sheep camps.

The Glen Innes and Tenterfield districts would not have suffered so severely in the drought, if it had not been that they were overrun with starving stock from other districts. Another cause was the scarcity of water in the back country where there was a fair amount of feed considering the season. Stock all kept near the water frontages and were too weak to travel into the back country where there was feed.

The Clarence River District.

MR. J. A. BULKELEY, B.Sc., Manager of the Belindigarbar Experimental Farm, reports:—The late drought, although not proving, perhaps, so disastrous on the Clarence as in some other parts of the State, can certainly be called the worst ever experienced on the northern rivers. Maize culture being the chief industry, this crop naturally suffered most. The practice of hilling the maize when from 18 inches to 2 feet in height was carried out on almost every farm. Several small areas were, however, cultivated on the flat, this system proving the more effective by minimising the surface area of land exposed for evaporation. Some 90 per cent. of the hilled crops failed entirely. The best results from this and all other crops were obtained by ploughing deeply, harrowing to a fine tilth and keeping the cultivators going as frequently as possible, thereby preventing the formation of a hard surface and enabling the soil to retain what little moisture it was able to absorb. Weeds were also by this means kept down, and evaporation of moisture per medium of their leaves prevented. Rolling proved in all cases unsatisfactory; it should only be adopted when required to break up lumpy ground and should always be followed by harrowing. Thinly sown crops gave the best returns by reducing the number of feeding roots and allowing each plant a greater amount of water than if the land had been heavily seeded.

Crops.—Our two chief crops, maize and potatoes, suffered severely. In the case of the latter, only a very small percentage of the resulting crops when harvested exceeded the quantity of seed sown. The maize stalks were mostly stunted and spindly, the cobs (when there were any) small, only partially filled with badly shaped grain, and in very many instances affected with weevil in the early stages of formation. A noticeable feature in connection with the cobs, also, was the great diameter of the core. Plants of the Cucurbitaceæ family were practically a failure, and instead of large shipments being sent to the metropolis barely enough fruit were produced to fulfil local requirements. On the Farm a few "True Ironbark" pumpkins did remarkably well, yielding a fruit of medium size but of excellent texture and flavour and good keeping qualities. Of watermelons, Black Spanish, Cuban Queen, Ice Cream, and Kolb's Gem gave best results. Long White Bush and Moore's Cream marrows fruited fairly well. Rockmelons failed almost entirely. The vines made good growth in the early part of the season, but later on the leaves wilted, and although a large number of fruits had formed they were badly sun-scalded and rotted long before ripening. The most drought-resistant crop grown on the farm was broom millet, sown in drills, from "White Italian" seed obtained from the Department. The flat system of cultivation was adopted. Each plant stooled out into several stalks, and the average height of the crop was between 9 and 10 feet. The heads were of exceptional length and the fibres very long, straight, and fine. Unfortunately the seeds were nearly all eaten by parrots before maturing, and the crop was cut and fed to stock. Horses and cattle eat it readily, and for green fodder or ensilage, giving, as it does, such an enormous

yield, it cannot be excelled. Perennial plants of all kinds withstood the dry weather remarkably well, even in places where they had only been recently planted. On the lower parts of the River, especially in and around Maclean, sugar-cane and cowpeas did exceptionally well, and even granting that more rain fell in that locality than at Grafton, both have proved themselves hardy to a marked degree. Of fibre plants, sisal hemp is the only one growing on the Farm, and on this the drought had no effect whatever. The same remark applies to pineapples. Considering the ease with which these latter fruits can be grown, and the rapidity with which they reproduce themselves, it seems strange that so little attention is paid to their cultivation. Even in low-lying parts, where frosts occur, small areas should be planted out, if only for the farmer's own use. A light covering of tea-tree bushes, straw, or corn husks, applied late in autumn, would prevent any danger from frosts, and the labour entailed in covering would be so slight as to be hardly worthy of notice. Amongst cereals, rye certainly took first place, both as a drought-resister and an early-maturing crop. Although not possessing the same nutritive value as oats, it makes a very good class of hay, and possesses the advantage of being, to a large extent, free from most of the diseases that attack other cereals. In addition, it gives a very heavy yield that will compensate for any lack of quality. Of all crops, however, lucerne showed out best, the only visible effect of the drought being shown by a slightly slower growth than usual. Most farmers having a small area under this crop were able, with an occasional purchase of cane-tops, &c., to hand-feed their cattle all through the drought.

Horses.—Of all classes of farm animals, horses suffered the least. Certainly, all that were not stall-fed fell away in condition very much, but the percentage of deaths from starvation, lack of water, heat, &c., was very small. Light ponies, hackneys, and light harness horses, especially if accustomed to being depastured, survived the drought remarkably well. Heavy draughts (Clydesdales and Shires) suffered more, as, being of a larger frame, they required more nourishment (which the high prices ruling for fodder in many cases did not allow of), and at the same time needed more attention in order to perform the heavy work required of them. Suffolk Punches suffered in a much less degree, their adaptability to all climates and all conditions again making itself manifest. This breed is rapidly becoming a favourite with farmers in all parts of the State, and in no case has belied the good name it has won for itself. The Suffolk Punch holds the world's record for heavy pulling. He is a comparatively light horse when compared with the heavy English draughts, and requires less feeding than the latter, at the same time being equal if not superior in point of strength. Lastly, but not least, he has a strong constitution and the absence of a heavy feather on the leg (where dirt and filth accumulate) necessitates less labour in grooming and prevents to a great extent such diseases as grease, etc.

Cattle.—All breeds of cattle suffered severely, the mortality being very heavy. Much of the land on the Clarence is of a very swampy nature and for the first time in many years most of the swamps dried up—in many cases completely. The scarcity of water was badly felt and a great number of farmers were forced to sink wells and pump water in order to meet the drinking demands of all classes of live-stock. Owing to scarcity of grass cattle became very low in condition and hundreds were lost by becoming bogged in the clinging mud left by the receding swamp waters. On the Clarence River pure bred cattle of any kind are scarce, so that very little data is available on which to form an opinion regarding the relative hardiness of the different breeds. Grade Durhams and Ayrshires seemed to hold their own

the best, Jerseys and other highly-strung, nervous types succumbing to the hard conditions imposed much more rapidly. The beef breeds all did fairly well, particularly Shorthorns and grade Herefords.

Sheep.—In the Grafton district sheep may be said to be almost an unknown quantity, nine-tenths of the mutton consumed being brought from Sydney by steamer. During the dry months of 1902 large mobs were sent down from New England to be depastured on the lower parts of the river. These were mostly merinoes and crossbreds and in all cases not only withstood the drought well, but put on flesh rapidly. Under normal conditions, however, the merino is totally unsuited to the district, as being too liable to foot-rot,

Pigs.—Tamworths, Berkshires and crosses between the two proved the most hardy. They have naturally strong constitutions and being good foragers, strong in bone and very active, will thrive and put on flesh where many other breeds would require extensive hand-feeding in order to keep them in anything like fair condition. The white breeds (small, middle and large Yorkshire) are quite unsuited to hot, dry conditions, being extremely liable to sun-scalding. The mortality amongst this class of farm animals was very low in spite of the fact that only small quantities of feed were available, and those of very poor nutritive value. At the same time most of the pigs fell away greatly in condition and very few were marketed.

Grasses.—On the farm a large number of grasses were tried with valuable results, the abnormally bad season giving exceptionally good opportunities for noting their various characteristics. Guinea Grass *(Panicum maximum)* that grows so well on the Richmond, only a few miles distant, failed completely; out of over a thousand plants tried only three survived. Some twenty plants obtained from Queensland, however not only withstood the heat and lack of moisture, but grew with amazing rapidity. This was probably due to the fact that the plants had gradually accustomed themselves to Queensland conditions, and proves that in a few years a plant requiring a large amount of moisture can be trained to thrive in a hot, dry climate. As drought resisters, rapid growers, and milk and flesh producers, the paspalums stand pre-eminently first. Of over one thousand plants of *P. dilatatum* put out in June, 1902, only two failed. The plot was thinned out early in the present year, and from the original stock we now have some 20,000 plants, the loss from transplanting being less than one per cent. *P. virgatum* proved a rapid, upright grower, if anything being more hardy than the *dilatatum*. *P. platycaule* was completely killed off, not a single plant surviving. *P. scrobiculatum* grew well, and stooled out rapidly. In the swamps water couch served as the best standby for all kinds of stock. Couch *(Cynodon dactylon)*, one of our best native grasses, died off rapidly. Other grasses that withstood the drought well were Giant Lyne, Cocksfoot, *Bouteloua oligastachya*, *Piptatatherum Thomasi*, *Piptatatherum paradoxum*, and *Stipa micrantha*.

Insects, &c.—The effects of the droughty conditions on insects and fungous diseases were very marked. In ordinary seasons the Northern Rivers are subjected to warm, moist conditions favourable to the development of fungoid spores, and the rapid spread of all insects peculiar to sub-tropical regions. During the last two years, however, the heat was characterized by its extreme dryness; and this, combined with an almost entire absence of food has kept these foes in check. Rusts of all kinds were conspicuous by their absence, and of smut hardly a trace was to be found. A few cutworms were noticeable, but in such small numbers as to cause but little trouble. Weevils were plentiful in the maize. Insects of the aphis group, cabbage moth, fruit fly, and others were also present only in very small numbers, and in many cases

entirely lacking. With the break up of the drought, however, the heat in the soil, combined with a plentiful supply of moisture, provided the conditions necessary for germination and growth, and both insect and fungoid diseases are now causing great damage to all classes of plants,

Lessons.—The lessons to be learnt from the drought are numerous. Chiefly it has taught us to conserve fodder and water. During the last two years the water supply on scores of the farms on the Clarence (and even at many places in the city itself) gave out, and wells had to be sunk and water pumped for starving stock, whilst corn husks, straw, and other materials of a like nature were eagerly purchased to keep the dairy cattle alive. No matter how good the normal seasons may be a permanent water supply should be provided. The cane tops should be conserved in the form of silage ; the heat engendered in the process of ensilaging devitalizes fungoid spores, and kills insects, and thus aids us in keeping our crops free from disease, whilst at the same time the labour entailed is little more than would be necessary to rake up the waste material and burn it off on the ground. The American method of harvesting maize, whilst the stalks and leaves are still partially green, should be adopted. True, the yield of grain would be somewhat lighter than if left until perfectly dry, but this would be more than compensated for by the conservation of a supply of silage that would tide us over any bad seasons that might occur. The corn-cobs, instead of being thrown on the dung-hill, should be crushed, because when mixed with molasses and a little salt added they make a first class fodder for cattle and pigs. Grow maize and potatoes by all means, but select quick-growing, early-maturing varieties, and, in addition, lay aside a fair proportion of land for oats, rye, etc., for hay. Where river flats of good depth are available lay an area down to lucerne ; it possesses this triple advantage :—It is a green fodder, a good hay crop, and makes excellent silage. Seed all available land with leguminous crops, such as cowpeas, lupins, field peas, etc., and when fully grown plough in as green manure. Not only will they enrich the soil by storing up nitrogen but they will provide a supply of humus which, when rain does fall, will absorb it more readily, and what is of more value, *retain it for a longer period.* Above all, no matter what crops we grow, let us select drought-resisting varieties. Although our maize crops have failed it is certain that by a careful selection of seed, and a thorough system of cultivation, we shall be able, in the future, to produce fair yields in spite of any adverse conditions that may obtain. In planting maize adopt the single grain system in preference to check planting ; the plants growing closer together keep the ground shaded, thus lessening the amount of evaporation. Seed the land early so that the crops can be harvested before the hot summer has a chance to damage them. Plant a variety of crops ; if some fail the others are likely to do well, or, at any rate, return us something for the labour and money expended. Don't overstock ; it is much better and much cheaper in the long run to have a surplus of fodder and grass in a good season than to have our stock die from thirst and starvation in a bad one. In clearing grazing areas don't ringbark *all* the trees ; leave shelter clumps in places to provide shade in summer and warmth in winter. Preserve all apple trees and swamp oak—the leaves and twigs of such make an excellent stand-by when the ground is denuded of grass.

Grafton Land District.

MR. T. RANKEN, Surveyor, reports :—The parts of counties Rous and Richmond, within 10 or 15 miles from the sea coast, and a considerable portion of the Sandy Creek and Bungawalyn country were not injuriously

affected by the recent drought. The rainfall near the coast, though not up to the average, was quite sufficient to maintain the pastures in a perfect state for dairying purposes. The swampy tracts in the county of Richmond, usually sour and wet, were greatly improved for grazing by the long spell of dry weather. The areas which suffered severely were those immedialely around Lismore and Casino, and the valley of the upper Richmond. In the afflicted areas the drought, in its worst stages, was marked practically by total failure of all crops, and almost total failure of the best qualities of grasses. On the upper Richmond all back water failed, or became poisonous. Maize growing in places sheltered from the north-westerly hot winds gave a patchy yield, but most of the maize of the 1902–1903 crop was cut for cattle fodder. On deep ploughed alluvial lands it was found practicable to grow cattle fodder.

Grasses.—The paspalum grass in the drought-stricken parts kept green, but did not grow. Buffalo-couch, which forms, as it were, a mat on the surface of the ground, held its own, and afforded a valuable stand-by for stock that were used to it, but it is not what can be called a dairying grass. It may be taken as a general rule that the succulent, nutritious grasses disappear during the progress of drought, while the hard, wiry, non-fattening grasses survive, or hold their own for a longer period. This is because in the first place the stock naturally feed the more edible grasses down first, and only turn to the hardier, coarser varieties when there is nothing else for them to eat. But even if the country were unsettled the softer, more edible, grasses requiring more moisture would disappear or stop growing before the rougher varieties. This means that the best dairying or fattening grasses cannot from the nature of things be the best—in fact must be the worst—drought-resisting grasses, and in a district where the usual rainfall is large, and the usual conditions therefore moist, and the vegetation therefore as it were acclimatised to those conditions, it is impossible to anticipate or attempt the productien of a grass combining nutritious and drought-resistant qualities. Farmers, moreover, will not encumber their paddocks with hard drought-resisting grasses, when average conditions are so eminently favourable to the production of the better fattening and milking grasses.

Water Conservation.—The principal lesson to be learned in this district, as in all others, is the necessity for water conservation. Dams, here and there, even in districts such as this, where the rainfall is usually abundant, do no harm, and would be the means of saving large numbers of stock, as for instance on the Upper Richmond, where stock suffered as much from the failure of water as from the failure of grass. In some parts of the district the watering places, or the conditions of the approaches to water holes, lagoons, &c., caused the loss of many hundreds of stock. The lagoons having dried up considerably, the edges were often boggy and unapproachable, and weak cattle getting in to drink could not extricate themselves. The fencing of such places, and the formation of gravelled or timbered approaches would prevent a great deal of this.

Pests.—During the drought dingoes increased in large numbers, attracted from their scrub haunts by the dead animals. Kangaroos, I believe, increased—not being molested by dingoes; and also on account of the increased growth of grass in the back country, where cattle could not go from scarcity of water. Snakes, to a large extent, disappeared, probably owing to the disappearance of frogs, field mice, grasshoppers, &c.

Stock.—Devon cattle, and Arab and pony breeds of horses best withstood drought conditions.

Lismore, Casino and Murwillumbah Land Districts.

MR. C. H. STILES, C.P. Inspector, reports:—I have been stationed in the above districts since May 14th, 1903, during which time there has been an abundant rainfall.

I understand that from September, 1902, to March, 1903, drought conditions, severer than anything previously experienced, prevailed over the whole of the Casino and part of the Lismore districts, the portion of the latter where drought conditions did not obtain being a large part of the Big Scrub country contiguous to the ocean, and which afforded some relief to stock from further back.

My information is necessarily only hearsay, but the consensus of opinion seems to be that *Paspalum dilatatum* and buffalo-couch grass (the latter not looked on with much favour in ordinary seasons on account of its coarse and somewhat innutritious nature) stood out pre-eminently as the best dry weather resisters on the basaltic soil of these parts, and that next to these two grasses come ordinary blue couch in affording the most feed for stock.

The Lismore and Murwillumbah districts are on account of excessive moisture consequent on frequent rainfall, unsuitable for haymaking, and in my opinion all that farmers require to do here in order to provide a certain food supply for their dairy cattle in any future possible dry spell (it would be a misnomer to call them droughts in comparison to what is known as such elsewhere) is to ascertain the very best means of saving their surplus fodder crops and paspalum grass in the form of ensilage, which they should allow to accumulate to meet any contingency in future.

Moss Vale District.

MR. J. YEO, Inspector of Stock, reports:—With the exception of the localities surrounding Picton, Camden, Albion Park and Dapto, a drought, during my term of office here, which has extended over a period of sixteen years, has been practically unknown in the Picton, Berrima and Kiama districts. The localities abovementioned suffered severely during the last drought, but I am of opinion that the dairy-farmers could have alleviated their trouble very considerably had they made provision in good seasons by storing ensilage and hay; of course some people will say you cannot keep hay because the mice will get into it, but my practical experience is that by putting it on a stage or straddle about 2 feet 6 inches or 3 feet from the ground, with an old milk dish turned upside down or a piece of tin or flat iron on the post, they can be kept out for years. Couch and native grasses resisted the drought longer than the artificial grasses, but there was very little difference between them as to their recovery.

Crops.—Oats, I think, resisted the drought most conspicuously.

Horses.—The small breeds of horses, hacks and ponies, proved the most hardy.

Cattle.—Ayrshires, Durhams and Devons proved the most hardy.

Sheep.—Merino, Shropshires and Crossbreds proved the most hardy.

Pigs.—I am of opinion that the Berkshires proved the most hardy.

(To be continued.)

The Cultivation of Native Flowering Plants.

BY JULIUS H. CAMFIELD,
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HOWEVER beautiful our native flowering plants appear when growing under natural conditions, it should ever be borne in mind that their degree of beauty may be vastly enhanced by careful culture. Shakespeare says:

> There is an art which doth mend nature,
> Change it rather,
> But the art itself is nature.

The fundamental truth of which evidently is, the possibility of the improvement of things natural by human art. And truly there exists an art in scientific floriculture, for although at the present time that same art is perhaps scarcely considered as existing upon the same plane as some others, yet surely the time must arrive when floriculture will be considered as art of a very noble and high order.

With all their charm and loveliness, our native plants, when growing naturally in the bush, seldom attain to that degree of excellence which, with the careful and intelligent attention frequently bestowed upon their culture, they are induced to develop, particularly in Britain and on the continent of Europe. In those countries, cultivated as they are for the most part in flower-pots, specimens are grown and exhibited in the various horticultural meetings which always command the admiration, not only of the casual observer, but of the horticultural connoisseur, who, in some instances, perhaps, has also witnessed the same species growing under natural conditions. Just as apples, pears, oranges and other fruits on the one hand, and the various examples of cultivated vegetables on the other, are unknown as such in a state of nature, so the grand examples of those living forms known as florists' flowers are altogether in advance of anything usually observed under essentially natural conditions; and that position holds good, even when the species themselves are cultivated as such, before they have become the subjects of the art of the scientific hybridizer. It is thus established as a first principle of floriculture that careful culture improves quality; and, indeed, improvement is the instinctive object of all ideal cultivation.

Generally speaking, the best method—that is, in the sense of being the most simple—that can be adopted in regard to the commencement of the cultivation of the native flowering plants is probably through the medium of seeds. But it will be understood that by following that method the virtue of patience will to some extent be called into requisition; but, undoubtedly, it possesses the merit of certainty, while also the development from germination to maturity will afford a varied and interesting domain for intelligent observation, and likewise—if sufficient interest can be commanded—also for experiment.

If then it be resolved to raise plants from seed, two systems present themselves for the choice of the operator.

First, the seed may be sown in ordinary 5-inch flower-pots. Having first placed a few small pieces of broken pot or other porous material in the bottom, in such a manner as to afford easy exit for superfluous moisture, then fill with soil, and after pressing the same moderately firm and leaving a space of ¾ inch between the soil and the rim of the pot, give a good watering from a water-can with a fine rose, so as to thoroughly saturate the compost, then allow to remain for a time to settle and drain; then sow the seed, distributing it evenly over the prepared surface, and covering it with about a ¼ inch of fine sandy soil, concluding the operation with another thorough watering from the fine rose. The compost employed need only be any good ordinary garden soil, only not too stiff—for preference, that of a sandy nature containing plenty of humus, rather than that of a too loamy texture. If an ordinary garden frame is at command, the seed-pots may be placed therein, keeping their rims perfectly level and about 9 inches from the glass of the cover-light. It is also a good plan to plunge the seed-pots in coal ashes or spent tan or even sand, their whole depth, the object being to secure an equable temperature and a constant degree of moisture. For a few days the frames may be kept quite close, but when germination commences, then the strictest attention must be given to the admittance of abundance of air, the back of the cover-light being kept well up night and day. Careful attention must be paid in regard to watering, for although the soil must never be allowed to become actually dry, yet moisture must not be permitted to stagnate about the seedlings; if so, they will in all probability "damp off," as the gardeners phrase is. The first two leaves—that is in the division of plants in this place more particularly treated of—are the seed-leaves, or, as they are technically termed, "cotyledons," and these usually appear in company; as soon as the third leaf is well developed then remove the cover-light altogether. As the seedlings develop gradually remove the weakest, and continue the process until only the strongest individual remains. If no garden-frame is available, the seed-pots may be placed in the lightest and most airy part of the bush-house; but in any case they must not be coddled, abundance of light and air being absolutely essential to their well-being. If neither frame nor bush-house are at command, then plunge the pots in an open piece of ground, and, if exposed to the direct sun-rays, stick pieces of tea-tree, or something similar, thinly on their north side, so as to furnish just the least amount of shade until germination is effected. When the plants are sufficiently strong and large enough—say from 4 to 6 inches high—transfer to their permanent positions. Excepting in the middle of either winter or summer, they may be planted out at any period of the year; indeed the planting may be performed even in the middle of the hottest season, providing they are well supplied with water during dry weather. Should free growth result after planting, it may be found necessary to give the support of a neat stick, to which the plant may be loosely tied. In removing the ball of earth from the pot at planting—which is done by turning the pot upside down, and

gently tapping the rim upon some hard substance, securing the ball with the left hand—be careful not to break it, merely remove the drainage pieces, as a great deal of the success of planting in this case depends upon keeping the ball of earth intact, so that the young and brittle rootlets are not damaged.

The second method referred to in regard to seed-sowing is to sow on the spot which it is intended the plants are permanently to occupy, and the system, although perhaps generally speaking is not to be preferred to that just advised, yet possesses certain advantages of its own, the principal of which is that the plant is never disturbed from the time it is sown, which, particularly in relation to native species, counts for a great deal. The finest Waratahs I ever saw in a cultivated state—if the term may be applied in this case—were growing on a small estate at Manly, and they originated from seeds, which the very enthusiastic amateur stated had been sown by himself on the identical spot where at the time they were in full flower, and that was not in the cultivated portion of the garden proper either, but in the " bush " garden. If then it be determined to adopt the plan now under consideration, it is recommended that two or three days previous to sowing a spade be taken, and the soil for about 2 feet square thoroughly turned over a good depth, say, as deep as the spade can be inserted, making the soil as fine as possible, and leaving the surface just slightly concave, then give a good watering, and, as directed, leave for a day or two to settle. When ready to sow press the bottom of a small flower-pot, or anything of similar form, in the centre of the prepared spot, making a depression about half an inch deep, in which evenly scatter the seed, filling with fine soil, and then give a good gentle watering from a fine rose. It will then be advisable to insert a few twigs round the spot so as prevent the too rapid evaporation of moisture. Water must subsequently be administered as circumstances require, that is to say, if the weather is hot and dry, about every other day will be sufficient; but if it should be dull or showery, then so frequent attention in that respect will not be necessary. When germination has been effected, and the seedlings are growing, adopt the same method of thinning as advised for the flower-pot plan. As soon as the seed-leaves show above the soil the twigs may be removed, and take care that no adjacent plants are allowed to encroach upon the spot. Also keep a sharp look out for vermin of all kinds; cats and birds are specially partial to newly-turned soil, and slugs and snails to young plants.

But supposing it is not intended to adopt the seed-sowing method, then a further plan for obtaining stock is to visit the bush and collect the seedlings or very young plants of the various species desired. Usually this is only to be accomplished with any degree of success subsequent to a bush fire, or at a place where the land has been recently cleared, for the reason that the older plants under normal conditions grow so close together that seedlings in such a case have but small chances of developing; but after a fire, or on recently-cleared land, and especially if rain has followed, the young plants may be found by thousands. Those needed should be carefully lifted with a garden

trowel, securing as many of the young roots as possible, and always choosing showery weather or a time when the ground is soft and moist. The best medium of conveyance is a tin box with a *close-fitting lid*. A little damp moss, or a handful of young grass or clover, sprinkled with a little water may be placed in the bottom of the box upon which the seedlings may be placed, and then shut *close down*. The principle to be remembered just here is that the roots are neither to see the light nor feel the air a moment longer than is absolutely unavoidable, for it is even here where so many amateurs make mistakes. How often has the ardent enthusiast taken plants from the bush which he intended planting in his own loved garden, but carried them home either with the roots exposed or wrapped up in a piece of *dry newspaper*, and then subsequently wondered how it was that after all his trouble his plants did not survive? As soon as the seedlings have arrived home it will be wise to "pot them up" as quickly as possible. If 4-inch pots are used, this is best done by placing three seedlings round the side of each pot at an equal distance from each other, for usually gardeners have an idea that plants succeed better round the sides than in the centre. This is a very simple operation, and by a practised hand can be accomplished in much quicker time than it takes to tell another; but it needs to be carefully performed for all that, and if it is possible to convey in words what is intended, then the *modus operandi* is something like the following:—Place a few crocks—which is the vernacular for the more classical term "potsherd"—in the bottom of the pot, and upon the top of these a little soil; then take a seedling carefully in the left hand, and with the right place a little more soil up the side of the pot nearest to the left hand, pressing the same with the fingers against the side, so that there is just the thinnest layer resting against the side of the pot, then place the seedling against the layer in an upright position, and just sufficiently deep, so that that part of the plant which is exactly where the root starts downwards and the stem upwards shall be about half an inch from the rim of the pot, then add a little more soil, pressing the same gently so as to keep the seedling in its proper position. Repeat the process with the two other plants, and then fill up the middle with the necessary quantity of soil, pressing down just moderately firm, the object of the process being, when complete, to have the three seedlings at equal distances round the sides of the pot, the roots as close as possible but not actually touching the sides, a space of about half an inch clear below the rim for watering purposes, and the plants in an upright position. Then give a good gentle watering. In dealing with seedlings in the above manner, when the operation is thus far complete, it will be an imperative necessity that they be sheltered for a day or two, until they have become established, and especially if at the time the air be very dry. A frame is the proper thing, or failing that, that part of the bush-house the least subject to the influence of wind. When once they have "got hold of the soil," which they ought to do in about a week, the pots can be placed in the open air with impunity; but until thus established they must be protected from drying winds, because until the equilibrium between the amount of moisture consumed

by evaporation be balanced by the quantity taken up by root action, artificial assistance must be given, or the result must necessarily be disappointing. Subsequently they may be treated as already directed above.

A still further plan, but one which can confidently be recommended to all who would prefer it, rather than either of the preceding, is to select established plants as they stand in the bush, and carefully remove them with sufficiently large balls of soil attached, conveying them with as little injury as possible to the place assigned them in the garden. This method involves some little trouble, and consequent expense, *e.g.*, a horse and cart, and the careful manipulation of a trained gardener; but it is always worth as much, if a successful result is desired. If, then, this method is determined upon, the first important factor is the selection of the most suitable plants, and this will require some little judgment. Those chosen should be healthy looking, *i.e.*, of a good green colour; further, they should not be too old, they should also be of good shape, not unequally balanced, but symmetrical, and not tall and "leggy," but plants as much as possible with their young growth from the base, or "bushy," as the gardeners say. These features as a rule are only to be met with in combination, in plants occupying to some extent isolated positions, as when situated very close together the growth is usually at the upper part, rather than at the base, in harmony of course with the instincts involved in the universal struggle for existence. The question is sometimes asked whether a plant may be cut back at the time of transplanting. Most British professionals would unhesitatingly reply with a most emphatic negative, and doubtless a sound principle is involved therein, and especially in regard to plants growing in a state of nature; at the same time, without taking an undue liberty with what is regarded generally as a sacred canon of horticulture, it will not hurt a plant to cut off, say two or three long straggling shoots, providing the lower part is furnished with healthy young growth. Having selected the plant, the next proceeding is to remove it, and whereas the selection required judgment, this part of the process as certainly requires care. Having then selected the plant to be removed, take a spade and insert it its full length—which will be about 12 inches—into the soil at right angles to its surface on the four sides of the plant, the distance from the latter to be regulated according to its size—generally about 1 foot square will suffice—then remove just sufficient soil from the outside of one of the cuts so that the spade may be pushed right under the plant, so that it now with its ball of earth rests upon the spade, then carefully lift it out, and place in the vehicle. Repeat the operation in regard to as many plants as it is purposed to remove, packing them close together, so as to as much as possible exclude the air from the sides of the balls. If a cloth can be stretched over the whole then so much the better, for the darker and the freer from air they are kept at this stage, so will be the measure of probable success. The next thing is to convey them home as quickly as possible, and then plant at once in the permanent positions previously determined upon, and indeed prepared. The preparation being that their assigned places have been well stirred up about 18 inches deep and a yard

square, with a liberal addition of leaf soil, or throughly decayed vegetable matter, or wood ashes, or about half a bushel or so of thoroughly decayed stable manure; but if this latter be used, be sure that it is as directed, *thoroughly decayed,* not fresh manure by any means. When planted let the top of the ball be just the least below the original surface, so that it will take a slight sprinkle of soil to bring it to its proper height. Then immediately the planting is finished give a thorough soaking with water. At the same time it will do no harm to stick a few pieces of tea-tree at a short distance from the plant, to afford shelter until established. Subsequently the matter of watering must be attended to according to the state of the weather. Although the lifting and transplanting of floral subjects can be safely done at almost any time of the year, except when the plant is carrying its flowers—that is assuming that the above directions are strictly adhered to—yet it may always be done with the least amount of risk just at the close of winter, say, about the beginning of August. It may also be stated here that the best time for the sowing of seeds is as soon as they can be obtained perfectly mature, the sign of which is in many cases that the capsules, or seed-vessels, commence to split, and, in regard to many of the Port Jackson and George's River species, the seeds are usually ready for collecting in October and following month.

Intending cultivators sometimes ask as to what kind of soil the native flowers require, and although that question has to some extent been anticipated in the foregoing, yet generally it may be laid down as a principle that the same soil which conduces to the well-being of ordinary garden subjects will suit the native flowers. It is altogether a mistake to imagine that the native flora prefer poor soil, which belief some folks seem to entertain, for the reason that usually they seem naturally to grow in such. But then we must not forget the truth contained in our great Shakespeare's lines, as quoted at the commencement of this article. Culture is everything in this world, and it applies to the vegetable kingdom in degree as also even to the human species. But, perhaps, our readers do not want our philosophy. Well, then, the native flowering plants will most certainly respond to liberal culture, if its principles are applied with intelligence and judgment. One mistake, however, must never be made, and that is to interfere in any way with their roots. Those organs must never be meddled with by either spade or hoe. Let that be remembered, especially when the ordinary yearly digging is done.

Regarding what may be termed the after culture of the specimens, a few remarks may be made. In some cases a little judicious pruning will be of advantage to the plant. In those which usually throw up a few comparatively tall shoots, such as *Epacris congiflora, Gompholobium latifolium* and *Boronia pinnata,* the best way to deal with them is, as soon as the flowering season is over, to cut back the long shoots, the effect of which will be to induce the plants to break, *i.e.,* produce new shoots, which must not be touched again until the next pruning season, which, of course, will be subsequent to the flowering. The reason why the pruning should be done immediately after the flowering is, that in many of the species suitable for cultivation the flowers are

produced in the axils of the leaves of the new growth, which has been forming since the previous flowering of the plant, and, unless those shoots have sufficient time to properly mature, they cannot form flower-buds; so that the pruning must always be performed previous to the plant making its growth for the current season. While the pruning is being done, attention should at the same time be given to the habit of the plant; the object should be to induce it to assume a good symmetrical form. Also, attention should be given to watering. All through the spring and summer months copious supplies should be given, particularly if the weather should prove very dry and hot, the evening being the most suitable time for the same. At the time just previous to the flowering—that is, when the flower-buds are commencing to swell—occasional waterings will also be beneficial; indeed, weak liquid manure, made by putting about half a bushel of horse-droppings into about 20 gallons of water, stirring up and allowing to settle, may with advantage be administered.

The following is a short list of species from which a choice might be made to commence operations. They are suitable for cultivation quite easily anywhere at least within 40 or 50 miles north or south of Sydney, and the seeds of all may be collected within a short distance of the metropolis, excepting the Hibiscus.

The first five are climbers:—

Clematis aristata, R.Br.
C. glycinoides, DC. (Hollyhock tree).
Hibbertia dentata, R.Br.
Hardenbergia monophylla, Benth.
Tecoma australis, R.Br.

The next six are large shrubs or small trees:—

Hibiscus splendens, Fras. (Native Beech or Black Wattle).
Callicoma serratifolia, Andr.
Ceratopetalum gummiferum, Sm. (Christmas Bush).
Xylomelum pyriforme, Sm. (Native Pear).
Telopea speciosissima, R.Br. (Waratah).
Doryanthes excelsa, Cor. (Giant Lily).

The following are of comparatively dwarf habits, say, from 2 to 3 feet, or a few a little taller:—

Zieria lævigata, Sm.
Boronia ledifolia, J. Gay.
B. serrulata, Sm. (Native Rose).
Eriostemon buxifolius, Sm.
Correa speciosa, Andr. (Native Fuchsia).
Phebalium dentatum, Sm.
Gompholobium grandiflorum, Sm.
G. latifolium, Sm.
Viminaria denudata, Sm.
Daviesia corymbosa, Sm.
Dillwyoria floribunda, Sm.
Horea longifolia, R.Br.
Indigofera australis, Willd.
Clianthus Dampieri, A. Cunn. (Sturt's [Desert Pea).
Acacia suaveolens, Lindl.
Bauera rubioides, Andr.
Kunzea capitata, Reichb.
Callistemon lanceolatus, DC. (Red Bottle [Brush).
Melaleuca thymifolia, Sm.
M. linariifolia, Sm.
Actinotus helianthi, Labill. (Flannel Flower).
Olearia ramulosa, Labill.
Cassinia denticulata, R.Br.
C. aurea, R.Br.
Helichrysum diosmifolium, Don.
Goodenia ovata, Sm.
Styphelia triflora, Andr.
S. tubiflora, Sm.
Leucopogon lanceolatus, R.Br.
Epacris longiflora, Cav. (Native Fuchsia).
E. microphylla, R.Br.
R. purpurascens, R.Br.
Sprengelia incarnata, Sm.
Prostanthera sieberi, Benth.
Isopogon anemonifolius, R.Br.
Persoonia pinifolia, R.Br. (Geebung).
Grevillea buxifolia, R.Br.
G. punicea, R. Br.
Pimelea ligustrina, Labill.
Pseudanthus pimeloides, Sieb.
Patersonia sericea, R.Br.
Dianella lævis, R.Br.
D. coerulea, Sims.
Blandfordia nobilis, Sm. (Christmas Bells).
Thysanotus tuberosus, R.Br. (Fringed [Violet).
T. junceus, R.Br.
Stypandra cæspitosa, R.Br.
Sowerbæa juncea, Sm.

The Culture of Fresh-water Fishes.

ALBERT GALE.

THE culture of fresh-water fishes as an industry is now carried on in America, England, and other European countries, giving employment to numerous families. The profits by the employment of this labour and the cultivation of these fresh-water finny tribes are equal to those of many other industries that are carried on solely for commercial purposes.

In England and on the continent of Europe during the great season for eating fish—Lent—the profits arising from the sale of this product, more especially the members of the great Carp family, are very great. The following is an extract, I think, from the London *Daily Telegraph*, which affords some idea as to the value of "farmed" fish. "The first prosecution under the new Act (an Act for the Prevention of Cruelty to Wild Animals in Captivity) took place on Monday, when an Oxford Street (London) fishmonger and his assistants were fined for cruelty to Prussian Carp, which were sold *alive* to Jews and Germans at Christmas time for 2d apiece. Into a tank 33in. long and 15in. wide, containing a depth of 7½in. of water, were squeezed 700 of the fish referred to, each from 4in. to 6in. long." The retail value, then, of these fish was not less than £10.

The *Standard*, in 1884, reporting of the Fisheries Exhibition, gives an account of a very large establishment for fish culture, involving a capital of about £12,000; this outlay was expected to yield a profit of something like 20 per cent. In this case the purpose of fish culture was more for the restocking of rivers and other watercourses for sporting purposes. The prices asked for and obtained for the fish were a good deal higher than would have been the case in ordinary commerce.

Artificial fish breeding was at first confined to that of the Salmonidæ family and was inaugurated about the middle of last century by Mr. Frank Buckland. The Sunbury breeding ponds were established for the purpose of restoring the river Thames and its tributaries to their former status as trout and salmon streams.

The river Tay and its tributaries had been equally decimated of finny inhabitants, chiefly fish of the Salmonidæ tribe, by the same means as in the case of the Thames. To restock this river and its tributaries, hatcheries and breeding ponds were established at Stormontfield. These two rivers, the Thames and the Tay, had been in the past notorious as localities for enjoyment of the ever-exciting pleasure of angling for trout and salmon. At that time the idea of general fish-farming was not entered upon, notwithstanding that the Romans carried it on fairly successfully. A fish farm, where fish could be obtained in all stages, from the ova to the marketable article, is comparatively of very recent date. The Fisheries Exhibition report already

referred to gives a detailed description of the "Howietoun system" of fish farming. Howietoun commenced working upon his system about the year 1870 with about 50 spawning fishes. Ten years later his stock of breeding fish amounted to no less than 40,000 and the eyed ova, *i.e.*, fish eggs that are known to be fertile, were about 6,000,000 per annum; and that did not include some 500,000 fry that are annually produced on the farm. The greater portion of these 500,000 fry are held over until they are yearlings and are then sold for the stocking of suitable waters. Some clue to the profits of fish culture may be gathered from the prices given for "partially-eyed" ova of the various varieties and species of the Salmonidæ produced at the fish farm under review. In passing, I may mention that only trout and salmon in varieties were expermented with, but if the same system be adopted with other fish the results will be equally successful, although the profits may not be so large, on account of the fish not being so valuable for table purposes. The following were the prices obtained for the partially eyed ova per 100,000:—*Fontinales* £60, *Levenensis* and *Fario* £45 for the same quantity. These were net prices and did not include the cost of transport and personal attendance to the place of destination. The price of ova rise inversely to the quantity required, thus 10,000 is 10 per cent higher and 1000 rise 50 per cent above this. 5000 fry costs £7 10s. for *Fontinales* (Char) and *Tevenensis* (the Loch Leven Trout) or *Fario* (Brown Trout) are each £5 for 5000; smaller quantities are double the price. The older the fish the greater the rise in price; yearling *Fontinales* are £10 per 1000, but two years old fish are *ten times* as expensive, *i.e.* £100 per 1000. Of course these are only for re-stocking waters denuded of fish. No one but a Rothschild or a Carnegie could obtain a dinner of fish at such a cost as this.

The foregoing results of fish farming have only to do with conditions and experiments that are conducted upon the most elaborate and scientific principles. Indeed the whole system is an artificial production of fish for the purpose of assisting Nature to replenish her waters whence man, for the purposes of food or sport, has "eaten the hen that laid the golden egg." The fish that have been most experimented with are those of the choicest species or that will conduce to the greatest amount of excitement to the sportsman. "What man has done man can do," is an old aphorism that is very applicable to experimenting with the higher classes of fish referred to, and fish of a hardier nature when thus experimented with, would be equally if not more, successful. Carp-like fish are more adaptable to ponds or stagnant waters than the trout-like fish. By carp-like fishes I do not mean the degenerate Gold-fish (*Carrassius auratus*), but the King Carp, Noble Carp, the Green and Golden Tench, &c. Some of the members of this great family grow from three to four feet in length and will weigh between 20lb. and 40lb. When once these fish are placed in suitable waters there is no further expense, Nature will do all that is required. At present the commonest sea or salt-water fish that are exposed for sale and sold by weight here in Sydney fetch 4d per lb. and the choicer kinds double

that price. A pond, if there be no natural waterhole, will pay for its construction and maintenance and the fish cultivated therein will be a valuable asset. There is no reason why these 30lb. and 40lb. fish cannot be produced in these States as is the case in Europe and America. Some of these fish, from a commercial point of view, would be worth at least 30s. per cwt.

No animals are more prolific than fish. Nature appears to have ordained that food fishes should be pre-eminently so. Amongst marine fishes the Newfoundland Cod (*Gadidæ morrhua*) is a well-known example. In the fishing season this fish gives employment to thousands and a food-supply to tens of thousands. The eggs produced by a single Cod-fish are estimated at the enormous number of 6,652,000, *i.e.*, a Cod-fish weighing 21½lb. and measuring 38in. long, and this is by no means an abnormal weight or length for a Newfoundland Cod-fish; and a Herring less than a foot in length (11½in.) is said to contain no fewer than 4,700,000 ova. But then these are salt-water fishes, and marine fish are always far more prolific than those that inhabit fresh water. An ordinary Carp weighing 9lb. contains 600,000 eggs, whereas a cod of the species referred to and of the same weight (9lb.) would contain twice that quantity. A 4lb. Tench will deposit at one spawning about 297,000 eggs, and a small English Perch weighing only 1½lb. is capable of being, in the course of a few days, the mother of no less 280,000 children. The Salmon and the Trout, two of the most delicate-fleshed fish that swim, 1lb. of roe of the first-named contains 900 eggs and a pound of the roe of the last-named 800 eggs. I have seen the roes of some of our native fishes (the Murray Cod (*Oligorus Macquariensis*) and some varieties of our fresh-water Perch (*Percaolates colonorum*) that must have contained some hundreds of thousands of eggs.

Notwithstanding the very great number of eggs deposited during the breeding season of any variety of fish, when in a state of nature, a very small percentage come to maturity on account of the numerous enemies that fish-flesh are heir to. In our rivers and lakes no sooner are the eggs deposited than they become the prey of aquatic creatures, and, of course, eggs have no chance to elude their enemies. The young fish, when pursued, rush into the shallow water and take shelter among the weeds that fringe the banks. I think all fishes, almost without exception, are cannibals. I have seen amongst my own aquaria fish the non-spawners intermingling with the spawners, catching and devouring the spawn as it extrudes. Further, I have seen both the male and female that have been engaged in the duty of reproduction, as soon as that interesting work is accomplished, search for their own eggs and greedily devour them. To in some way compensate for the state of things here narrated, Nature has designed that the period during which the eggs are developing to maturity shall be short. The time that elapses before the eggs hatch is seldom more than six days, and when the weather is warm I have known the young fish to appear in from 70 to 75 hours. These are the periods in some of the Carp family. I have seen the eggs of my Paradise fish (*Macropodus venustus*) mature in 36 to 40 hours.

When fish life begins fish troubles begin. Young fish no sooner escape from their imprisonment in the egg than they find that their enemies have increased rather than diminished, and their chance of escape is little or no better than it was during the egg period. During the first few days of their existence the young fish are almost motionless, and so they remain until the absorption of the yolk-sac. As the young fish grow, so their powers of locomotion increase, and then they are somewhat relieved from the pressure of their enemies by availing themselves of the protection before mentioned, where their larger brethren cannot follow them.

I said just now that Carp are cannibals. Not only do the old fish devour their own eggs and offspring, but I have seen the young of these fish, when not more than $\frac{3}{4}$in. long, catch and devour their smaller and weaker brothers and sisters. Indeed, I have seen the bait nearly as big as the biter. When fish are living in a state of nature it seems almost a miracle that so many of them come to maturity. If the large number of eggs of the Perch, Tench, and Carp that I have referred to (and these are the fish best suited for pond culture) were all fertile and the young fish came to maturity, a very few stock or breeding fishes would be enough to produce fish-food for a whole district. With the numerous enemies that fish are surrounded with—enemies in the air, enemies in the water, and enemies on the land—the wonder is that defenceless fish are not more frequently exterminated. In a state of nature fish increase rapidly where the best conditions exist for their preservation—*i.e.*, where there are long stretches of water entirely free from weeds, these alternating with shallows containing dense masses of aquatic herbage. In some of our inland fresh-water rivers and creeks the places where there is open water surrounded by weeds are always the favourite breeding grounds for their finny inhabitants. Such spots act at once as good spawning grounds and give ample protection for the young fish when hatched. Fresh water fishes either spawn in or on the gravel or sandy bottoms of their habitat or amongst the weeds. Few, if any, spawn on the surface of the water, as is the case with some of our marine fish. Weeds are the favourite breeding grounds for the Carp family. The eggs of these fish when extruded are soft and covered with an adhesive gelatinous substance. The first object touched by these eggs after extrusion is adhered to, and the adhesive matter surrounding them quickly hardens, and in this way the eggs find additional protection. While the eggs are in the act of being fertilised the water is in constant motion caused by the agitation of the fish. This motion given to the water by the fish scatters the eggs broadcast amongst the weeds. Carp always come to the surface to spawn. The spawn is extruded by sudden jerks. I have seen it, when the fish have been greatly agitated, thrown free from the water and adhere to the sides of my aquarium. The whole of the eggs in the ovary or roe of a carp, as previously referred to, are not extruded at one time. The process of spawning continues for hours; indeed, I have known it carried into the second day. With each spasmodic motion of the fish from 6 to 100 eggs are extruded. Thus it will be seen that aquatic plants, or an equivalent, are a

necessary adjunct in the breeding grounds of these fish. All rivers and waterholes or ponds have their beds on more or less of an inclined plane, and, as a rule, the largest fish tenant the deepest waters, and the smallest fry are found nearest the margins of the shores. The reason for the small fish inhabiting these localities is not far to look. They are constantly being pursued by the larger fish, and shoal waters are therefore protective to the smaller fish; but, when driven into shallow water, they at once become a prey to their terrestrial enemies; these latter they elude by concealment.

The foregoing gives in brief the conditions and design, or rather the form and its adjuncts that Nature gives, or that are chosen by the fish for the purposes of reproduction. Inspection of any such natural breeding ground will give any one an idea for the construction of an artificial breeding site for fish. All artificial waterholes are constructed upon this plan—*i.e.*, shallow margins and deepening towards the centre. It is quite natural that it should be so. The approaches to a waterhole are always so constructed to give easy access. The shoaling of the water towards its margins is a favourable condition for the propagation of fish, and this is to be met with in every drinking hole for stock. The only other necessary adjunct is the supply of suitable aquatic plants. I have already named and described many of them. Any plant that will live and thrive in water is suitable for that purpose, but of course there are some more suitable than others.

The propagation of fish in their natural habitat is surrounded with many dangers. The hundreds of thousands of eggs produced by each spawner and the few fish that come to maturity is sufficient evidence in proof thereof, and the more the spawn and young fish are protected the better will be the achievement of the results. Given a waterhole, deepening towards the centre, the margins thereof planted with water plants that have become fairly well established, and a dozen or even less fish of a chosen variety introduced would supply any one's table with a fair amount of fish for food purposes. In introducing the first lot of fish for breeding purposes, it would be well to select an equal number of milters and spawners (males and females), or if there be preponderance of one sex over the other it may be on the side of the spawners. Most persons must have noticed amongst tinned herrings and other fish some containing a soft and others a hard roe. The soft roe is the milt of the male or milter, and the hard roe is the spawn of the female or spawner. It is a very difficult matter for inexperienced persons to distinguish between the genders of fish, especially the Carp. During the greater part of the year the sexual characteristics between the males and females are almost indistinguishable by the naked eye. By close observation there will be seen on the gill-covers (opercles), and also on the pectoral fins (shoulder fins), on and between the first two rays thereof, small excrescences like small pimples. These only appear on the male fish. These masculine markings become very pronounced as the spawning season advances. As the season advances these distinguishing marks become more white, beautifully shaded with

rainbow tints. To be acquainted with these facts is a great advantage in the breeding of certain classes of fish. This I shall point out further on when dealing with the subject of breeding fish in small vessels for the purpose of restocking ponds when necessary.

All animals improve under the fostering hand of man. Even Nature can be greatly assisted by protective conditions and the destruction of natural enemies. Fish being placed in a pond having the conditions named would thrive and multiply therein if left entirely alone to their own sweet will.

No one will dispute the fact that domestication not only improves the quality but size of animals. Domestication also increases the demand, and demand in its turn adds to increasing numbers. Although fish will naturally increase in numbers if treated as before described, there may be conditions in which it may be necessary to resort to artificial adjuncts to re-stock ponds that may become more or less exhausted. The size or shelter and protection being insufficient will contribute largely towards exhausting the domestic supply of fish.

If the weed-growth be insufficient for protective purposes, bundles of brushwood sunk at intervals in the pond will answer the purpose well, but we must bear in mind they supply no food. So as to enable these bundles of brushwood to become a source of food to the young fish it would be necessary for the brushwood to have been in the water a sufficiently long time for the spores of some one or other of the fresh-water *algæ* to have started into growth thereon. That sheen-like moss met with on stones and other objects in waterholes forms a grand grazing ground for Carp, more especially for the younger members of the family. In my own aquaria I have often watched the young fish when not half-an-inch long feeding ravenously thereon.

Then again, artificial means may be adopted for collecting the spawn that has been deposited in the ponds or other waters and hatched elsewhere. You will remember the great destruction the spawn is subject from the period of its extrusion until it hatches, the exciting times the young fry have to retain their little lives, and the few there be that pull through babyhood. As a rule the Carp family delight to commence spawning in the early morning, just as the sun comes glinting on the surface of the water and continues until about noon, but I have known them to continue till sundown and even after. They generally select the sunny side of the water where the weeds are thickest. In breeding seasons and on the approach of the spawning period the sexes will be seen chasing each other hither and thither, the males constantly trying to chase the females that are in the weeds to the surface of the water. When once there the fish will be seen rolling and tumbling one over the other, the milters constantly forcing the spawners upwards. Then there will be a splash, and the fish will be seen darting away in all directions to renew the same tactics again a few minutes hence. The moment the splash I have referred to is seen that is the time that the extrusion of the eggs from the spawner takes place and also the milt from the milter. Fish eggs are fertilized *after* extrusion. These eggs then gradually

sink through the water and they adhere to every object they come in contact with.

If then, the ponds are found to be deficient in weeds, these may be obtained from elsewhere. Pull them up by the roots. Well wash both the roots and the foliage tying them in loose bunches and deposit them in the water, so they float on the sunny side of the fish pond in early spring when the fish are seen playing about as described.

If tubs or other vessels be filled with water from the same pond in which the fish have spawned, for the purpose of the eggs retaining the same temperature, and the weeds in which the fish have spawned placed therein, in a few days hundreds of tiny fish will be seen hanging to the weeds. Don't disturb them. In a short time they will be darting about in the water. They grow rapidly and when sufficiently grown they may be returned to the waterhole, but be sure you have placed sufficient cover for their protection from enemies.

I have hatched hundreds of Carp in quart bottles. It is interesting to watch the eggs developing. In a little more than 48 hours, according to the temperature, two little black spots will be seen to put in an appearance in each fertile egg. This change in the egg is termed "eyeing." The spots become more pronounced as the egg approaches maturity. Just as the egg is about to hatch there will be a little quivering motion, the semi-opaque covering of the egg will open, the tiny inhabitant emerge, stretch itself, hang up close to the discarded egg-shell, tail downwards, expand its tiny gill covers and take its first draught of oxygen. I have sat and watched for hours the little fish forcing their way out from their imprisonment. It is an interesting sight. At the time they emerge from the egg they are almost transparent. Who would ever think these little fragile creatures would grow sufficiently large to be a meal for a fairly numerous family? Yet it is so.

Mules.

On the subject of breeding mules, a writer in the *Nebraska Farmer* states that for the production of the mules most generally in favour for farm work, chunky mares of pony ancestry back two or three generations are bred to a big Missouri jack. The progeny of such a mating have the compactness, activity and quality that makes them very desirable for every day use in teams. The cheapness of raising mules in the western and north-western ranges commands the industry to stock-breeders. In the sandhills country, that scarcely affords sustenance to horses or cattle, the mule thrives, and at 3 years of age is ready for market.

Hawkesbury Agricultural College and Experimental Farm.

A Trial of Two Methods of Planting Swede Turnips—Ridge and Level.

By GEO. L. SUTTON, Experimentalist.

THE object of this experiment is to determine whether the practice, common to some localities, of planting the swede turnip on ridges is necessary or beneficial.

For this experiment the plot, 1 acre, was marked out in rows, 2½ feet apart. Every fourth row was ridged before planting by throwing two furrows together over the line with a single furrow plough and thus forming a crown or ridge. The plots under trial consisted of alternate drills of swedes planted respectively on the level and on ridges. These plots or drill, though not adjacent to each other, were as close together as the nature of their method of planting would permit.

The soil was a pipe-clay loam rather heavy and not very well drained and of such a nature that to plant ridges would appear to be the most suitable method especially in a wet season.

No manure or fertilizer was applied directly to this crop; in March, 1901, the land had had an application of about 10 tons of stable manure, and since then had produced two light crops of rape and linseed, which were removed. The ground had been fallowed from December to February, when it was ploughed and prepared for this experiment.

The seed, at the rate of 3lb per acre, was sown on March 3, 1903, that planted on the flat was sown by the "Farmer's Friend" maize drill fitted with the turnip plate; that on the ridges was sown with the "Planet Junior" hand seed drill.

The seed germinated well and grew vigorously. The plants were thinned out and chipped on April 1, 1903, single plants being left eight inches apart.

The weather throughout was very favourable for the growth of this crop, in fact continued so moist after the thinning, that the amount of inter-tillage usually given to this crop could not be done, nor was it necessary.

The first pulling was made when sufficient turnips to warrant the harvesting were large enough for market. This took place on June 14th and 18th. The drills were pulled in rotation, commencing at No. 1. The second pulling was made on August 12th and 14th, at this time the whole of the remaining swedes were fit for market.

The portion of each drill weighed was 2 chains long and situated in the centre of the drill. Before weighing the tops were removed and the roots trimmed ready for market. This was done thoroughly. After weighing, the crop was bagged and sent to Redfern, where it realized the highest ruling rates. The results are as follows:—

Plot.	Method of Planting.	1st Pulling. Weight of Trimmed Swedes. Per Plot.	1st Pulling. Computed weight per acre.	2nd Pulling. Weight of Trimmed Swedes. Per Plot.	2nd Pulling. Per Acre.	Total Computed weight per acre.
		Lbs.	Tns. c. q. lb.	Lbs.	Tns. c. q. lbs.	Tns. c. q. lbs.
B 2 ...	Flat	34½	2 0 2 18	112	6 12 0 0	8 12 2 18
B 4 ..	Ridged	9½	0 11 0 22	100	5 17 3 12	6 9 0 6
B 6 ...	Flat	48½	2 17 0 18	100	5 17 3 12	8 15 0 2
B 8 ..	Ridged	53	3 2 1 24	78	4 11 3 20	7 14 1 16
B 10 ...	Flat	39	2 5 3 24	128	7 10 3 12	9 16 3 8
B 12 ...	Ridged	62½	3 13 2 18	112	6 12 0 0	10 5 2 18
B 14 ...	Flat	50½	2 19 2 2	129	7 12 0 4	10 11 2 6
B 16 ...	Ridged	55	3 4 3 8	113	6 13 0 20	9 18 0 0
B 18 ...	Flat	30¼	1 5 2 17	149	8 15 2 12	13 3 1 1
B 20 ...	Ridged	82½	4 17 0 25	107	6 6 0 12	11 3 1 1
B 22 ...	Flat	27½	2 15 2 26	117	6 17 3 16	9 13 3 14
B 24 ...	Ridged	64¼	3 16 0 2	115	6 15 2 4	10 11 2 6
B 26 ...	Flat	89	5 4 3 16	113	6 13 0 20	11 18 0 8
B 28 ...	Ridged	87¼	5 2 2 9	89	5 4 3 16	10 7 1 25
B 30 ...	Flat	63¾	3 15 0 15	131	7 14 1 16	11 9 2 3
B 32 ...	Ridged	119½	7 0 3 10	62	3 15 0 8	10 13 3 18
B 34 ...	Flat	38	2 4 3 4	114	8 9 2 24	10 14 2 0
B 36 ..	Ridged	107	6 6 0 12	70	4 2 2 0	10 8 2 12
B 38 ...	Flat	71	4 3 2 20	112	7 3 3 4	11 7 1 24
B 40 ...	Ridged	115	6 15 2 4	42	2 9 2 0	9 5 0 4
B 42 ...	Flat	94	5 10 3 4	91	5 7 1 0	10 18 0 4
B 44 ...	Ridged	119	7 0 3 10	50	2 18 3 20	9 19 3 2
B 46 ...	Flat	134¼	7 18 0 25	56	3 6 0 0	11 4 0 25
B 48 ...	Ridged	101½	5 19 2 14	8	0 9 1 20	6 9 0 6
B 50 ...	Flat	74¾	4 7 2 11	13	0 15 1 8	5 2 3 19
B 52 ...	Ridged	93	5 9 2 12	15	0 5 3 16	5 15 2 0

TABLE showing gain due to method of planting.

Method of Planting.	Average Yield per acre.	Increase.
Flat	10 tons 1cwt. 0qrs. 25lbs.	———
Ridged	9 ,, 3 ,, 0 ,, 22 ,,	18cwt. 0qrs. 23lbs.

It will be seen that there is a slight advantage in favor of planting on the level.

When the nature of the season and the soil is considered, this result, though so slightly in favour of level planting, indicates that the additional labor of ridging is unnecessary.

It will be noticed on studying the results that the yield of first pulling of the swedes planted on the ridges was in excess of that of the second pulling, and also heavier than the first pulling of those planted on the level. It is therefore apparent that when earliness is a consideration, ridge planting is the method to be adopted.

A Fungus Disease on Garden Peas.

C. T. MUSSON.

THERE have been submitted (Nov. 27.) from Waverley, Sydney, peas suffering from a powdery mildew, a disease which has been rare in the past. The writer said "these peas which a few days ago looked quite flourishing are covered with a disease like mildew, causing them to smell horrible; the stocks are dying."

This disease is of the *Oïdium* type and is caused by a fungus parasite, *Erysiphe Martii* found on clovers, beans, vetches, lupins, crucifers and other plants, in Britain and in North America. This is the first occasion on which the trouble has been submitted to us.

It may be noted that there is another mildew disease but of a putrefactive character very deadly in its effects somewhat similar in appearance found in peas, the cause being a fungus distinct from this one, and the same treatment is not effective, the only safe remedy in this case being burning the infected plants.

For this oïdial disease the *treatment* should be powdered sulphur. Soot has been recommended, but its effects would not be so good as is obtainable from the use of sulphur applied in the heat of the day dusted through cheese cloth.

The disease will in suitable weather rapidly travel through a crop, and probably, unless the remedy be applied in the initial stages of the attack, it is worse than useless. In such case, the diseased plants should be pulled and burned. And seeing that this disease occurs on a number of common vegetables, careful rotation should be practised in the garden as the germs resting on any buried portion of diseased plants will, in many cases, be enabled to communicate the disease to later crops; therefore the ground that produced this disease should not for a year at least be planted with peas, beans, cauliflowers, cabbage or turnip. This would restrict the possible crops, and if allowed to lie fallow and carefully kept free from growth of any kind, or a small plot of something grown that could be dug in if remaining uninfected, so much the better. Careful rotation will prevent the pest from re-appearing, in all probability. It is a peculiar fact that such attacks seldom come two years in succession. Once coming however, we are always liable to them. Growers should therefore be on the look out for any appearance of "mildew" and take immediate steps to check it.

Ensilage.

H. W. POTTS.

IN many parts of the State the late November rains, and the general prevalence of low temperatures, have combined to make the successful conservation of our enormous surplus of green fodder into hay a very difficult task. Rain has fallen in the most fitful and inopportune

times for hay-makers. Under such extreme circumstances we are compelled to consider the question of storage, or conservation, as ensilage. Necessarily, such entails more expense. There is much more waste in the stack from it than the more scientific and effective method of storing it in air-tight tubs. In dealing with ensilage in large quantities this season no time is available to erect tubs, and the only feasible way is to make stacks. The larger the stack, the less waste, and the greater certainty of the food keeping in palatable form for a lengthened period. I have seen a stack opened ten years after building, and the food material was in admirable condition. In this case there was a total weight of 200 tons. The waste in small stacks is considerable, and has been known to reach 15 per cent.

The main principle to ever bear in mind when stacking ensilage is to exclude air. This does not involve the adoption of expensive means to create weight, or extreme pressure. This so largely depends on the skill of the man either building the stack or supervising its erection. Stack immediately after cutting the fodder or grass.

The site for the silo should be carefully selected so as to ensure complete drainage—not from the material in the stack, as is often imagined, but to prevent the inflow of water into the foundation from rains, or soakage. It is impossible to intimately describe the conditions essential to good conservation; so much depends on the local facilities and conditions.

Sound judgment and common sense must be utilised to determine the best site. In building a stack of green fodder it has to be remembered that considerable shrinkage must take place, and if great care is not exercised in stacking evenly, and firmly, when condensing, the stack may become lopsided, or shrink unevenly. Every layer must be tightly and firmly packed, to ensure the removal of entangled air. Success largely depends on how the material is stacked. When a sufficient height is reached, the question of weighting, and protection from rain has to be considered. The wisdom of weighting involves some thought. Many contend, as the result of practical experience, that it is essential to weight heavily, and others that such is a waste of material and time. At the College we followed the plan this year of spreading a layer of maize stalks over the stack, and these were firmly held by fencing wire passed over the stack at intervals, attached to fairly heavy rails. The ensilage is a complete success, and we evaded the cost of labour and material in the usual practice of weighting.

It is possible to conserve immense quantities of fodder in this way. Natural facilities are frequently available in selecting a suitable site in proximity to the fodder it is proposed to cut. In most instances this class of ensilage is fit to feed in from three to four months after the completion of the stack. The food value of three (3) tons of well made ensilage is equal to one ton of oaten hay.

As a fodder for dairy cattle during our periods of scarcity, it stands next to green grass, and it is known to be especially valuable in prolonging the milk flow. Forty pounds per day in combination with lucerne hay, bran, copra cake or linseed cake, forms a class of ration eminently suitable for stall feeding.

Feeding beef cattle with ensilage has been attended with great success. As a rule horses do not take kindly to it, but instances are recorded where it has been used with good results when the animals have been gradually broken into its use.

With sheep many tests have been conducted to test the feeding value of ensilage, and the returns have proved highly satisfactory. It was noted that silage-fed ewes suckled their lambs much better than on an ordinary grazing ration.

WEEDS OF THE FARM.

(A Paper read at the November Meeting of the Hawkesbury Agricultural Society)
BY C. T. MUSSON.

Definition of Weeds.—Weeds are a remarkable (I had written misunderstood) group of plants. The ceaselessly persistent qualities they possess if found in man would merit unstinted praise. For have they not found the way to live everywhere and to multiply exceedingly in spite of our increasing attention to them and of all other obstacles?

Sweet Briar.

There is something in the definition of weeds given by one of our students. "Weeds are things which Adam had to contend with in the Garden of Eden for disobeying God;" if we read this, "weeds are things which man has to contend with in the great world's farm," we have

a good working definition, and we may note that the weeds win or we must: there are no half measures in nature. Our attitude towards them should be that of a philosopher—they are here; they must be endured; but we *must* fight them, and we *must* win.

For practical purposes we adopt as the point of view from which to consider weeds that of a grower who requires soil produce in sufficient quantity (commonly understood as a *large* quantity), and of good quality (quality is often sacrificed for quantity; a mistake made by all except those who know the result). Our standpoint is therefore a personal one.

Carrot-weed.

Now what do we really mean by the word "Weed"? It is necessary to get a definition as accurate as possible as to what plants are weeds, and why, and then consider which of them need our special attention: for many are neutral in their action. We may describe as 'weeds,' "any plants growing out of what we consider their home position, if they interfere with us in any way." Couch is a weed in the orchard, whilst in the paddock is a useful plant. Another good definition is "plants which tend to take prevalent possession of the soil used for man's purpose, irrespective of his will." Still another, "any uncultivated plant when troublesome." This latter we can take as our idea of a weed; and weeds are mostly herbs. It is an interesting fact that weeds are weeds in that they have been successful in resisting the adverse influences in life: they are the successful competitors in the plant race for positions as colonists; they are hardy, prolific, ubiquitous, successful travellers, not at all fastidious as to soil, situation, or food; they respond luxuriantly to the good things of life.

Consequent upon the mildness of our climate, and for other reasons, they have exceptional chances in this country; there is every opportunity here for pushing plant travellers to get a footing. In cultivating we make the ground bare: our native grasses are more or less of a tussocky habit, hence there occur numerous bare patches of soil between the individuals forming the plant covering. (Couch is a colonist of a kind; in early days it was not nearly so widespread as at present.) Animals make trees and fences their rubbing posts and lay bare the soil by trampling about them. Our stock routes are of soft ground mostly, and readily become bare under the influence of grazing and the wear and tear of innumerable feet. On these bared patches seeds fall, and with the first rain germinate; all seeds then have an equal chance. The weeds, of exceptionally hardy nature push up and frequently crowd out the native vegetation; sometimes of course not entirely to our disadvantage.

Nature started making the hardy weeds what they are, and man with his cultivation process finished the process by providing opportunities for such plants as developed the talent to become the successful invaders, our "weeds"! Their hardihood and numbers are due to special endowments which fit them for success in the battle of life. Possession of these endowments gives them an inherent power to seize every opportunity presented. These endowments have actually made weeds travellers; chief amongst the causes which have made them aggressive is the fact that they have means for ready and certain distribution; the seeds or fruits are constructed in such a way that they have exceptional facilities in this direction, for instance in the possession of a balloon-like attachment as in thistles and dandelion, or of hooks for attachment to animals, as in burr-plants.

No doubt the increase of weeds is largely due to neglect from growers not being aware of their noxious nature and power of spreading and consequently leaving them alone, together with the occupancy of large areas of land and the absence of an "off" season when attention could be specially directed to their extermination or reduction.

If we are to understand weeds and adopt the right view as to their nature and action, we must first recognise the facts stated and grasp the idea that from the weed point of view they are the successful colonists amongst plants; this will help us in fighting them, for if we know the reasons why they are strong we can attack them at such times and in such manner as will prevent them developing their strength; thus they remain weak, without those special powers which render them strong to fix themselves and retain their hold.

Is the strong point seeding? Then we must prevent it. The Canada thistle produces 42,000 seeds, a mallow 16,500, sow thistle 19,000, pigface 100,000 (the numbers are approximations).

Is the possession of underground stems or tough root-stocks the strong point? Then we must prevent the plant digesting and breathing by not allowing leaves to develop, for *they* are the stomach and lungs of the plant.

It will be seen therefore that we strengthen our position if we know the habits of the various weeds; no two are alike, and the contrivances

they possess of special use to their needs are as varied as the plants themselves. They all, however, possess one characteristic in common, perhaps the most important of all, adaptability; a remarkable ability to adapt themselves to any and every kind of surrounding.

In this country we have many remarkable structural features in the native plants which enable *them* to tide over the droughty periods—but the weeds are never in the rear; Nature's hard and relentless school in which it is *live or die,* has developed them as we find them to-day, pushing in and along anywhere and everywhere.

The Bad Points of Weeds.

In reviewing weeds we may recapitulate shortly the reasons why they are detrimental.

(*a*). They involve extra labour and may even bring about a change of rotation.

(*b*). They establish competition for food materials and light and smother out weaker or even useful plants; it depends largely on the stage of growth whether weeds smother the crop or the reverse, in some cases they do take complete possession of the ground and may thus crowd out completely everything else. We may note in passing that (other things being equal) weeds are hardy and prolific as compared with most cultivated plants, for the very fact of cultivation coddles the latter into a more or less weakly condition—chiefly because they are forced along one line of development to the suppression of other phases of the plant life, thus disturbing the natural balance; in such a condition plants become more liable to disease.

(*c*). Weeds encourage evaporation of soil moisture. The amount evaporated here in one year may be set down approximately as follows, based on the actual amount measured as lost from a water surface during 1902, and observation by Mr. Russell at Sydney Observatory:

Annual Rainfall Average.	Water evaporated from bare earth; surface constantly loosened.	Water evaporated from grass land, or land covered by weeds.	Evaporation from a water surface.
32 inches.	33 inches.	45 inches.	47 inches.

Of course there must be moisture to evaporate or the process slows down and may stop: the effect of plants on evaporation is, however, well seen in these figures.

(*d*). Weeds afford a shelter and food for injurious insects and plant parasites. The common wild cresses (pepper weed and wild carrot, for instance) are the hosts of two very injurious fungus parasites which attack cauliflowers, cabbages, turnip and rape at times. Henbane is the host of a common and destructive tobacco disease. Hence we say, keep down these and such like doubly-detrimental weeds by all means in our power. Of course we must know the weeds and parasites; herein is one important reason for gaining knowledge on this question.

Pig-face—
a weed
of
cultivated
land.

False Chamomile—milk tainter.

(*e*). Weeds add impurities to grain or green feed, of a prickly, sticky, or evil-smelling nature. Some are bad milk tainters, whilst some are poisonous or otherwise detrimental to stock. At the present time we have under investigation at the College a case of milk tainting resulting in serious loss from inferior butter. Also, another important case in the poisoning of some of our sheep, the suspected plant being the Yellow Rush Lily, a small introduced Iris.

Weeds Sometimes Favourable.

We may now consider certain favourable points to be credited to weeds, which should by no means be omitted. (*a*). They are useful as covering the soil surface in times of dry windy weather: better, of course, to have a green manure crop of a more valuable nature doing so, some legume for instance; but, failing that, weeds will prevent the blowing away of soil from about the roots of trees. We have had apple trees killed by this baring of the roots, whilst experimental crops of young cereals have been partially or entirely smothered by blown sand. Naturally, 'timing' in connection with the wind is the difficulty.

Plantain or Lamb's-tongue.

(*b*). In hilly districts weeds, if present, will prevent the washing away of soil: a source of much irritation and subsequent labour in certain places. Here again, a regular rainy

season is requisite in order to take full advantage of such a circumstance.

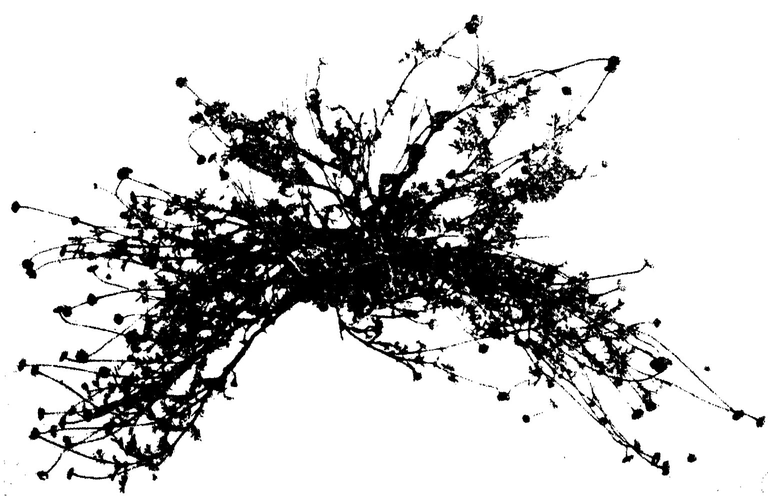
(*c*). Many weeds in pasture country help to make up a good food mixture for stock—giving tonics, bitters, purgatives, and so on; useful and indeed necessary to good health. An increase in the proportionate amount of any one of such articles of food might, howevever, cause serious trouble. In some cases they give valuable winter food, as in crowfoot and clover burr.

(*d*). They supply green manure to the soil when ploughed in, but not of such bulk and character as a clover or rape crop for example.

(*e*). They help to draw material for plant food from deep down in the soil, which is soon rendered available when the weeds are ploughed in.

How Weeds Originate.

We may now consider shortly how we get our weeds. Where do they come from? Most of them have been introduced from other countries without special intent—in dirty seed; in the packing of merchandise, hay, straw, &c., being often used for this purpose. I have taken thirty-five species of recognisable plants from meadow hay in which glass beakers have been packed, some of them of a detri-



Cotula—a milk tainter.

mental nature. Large collections of weed seeds have been obtained from linseed, cereal and grass seeds.

Once here weeds spread rapidly: largely along the railways and roads; by means of travelling stock; in manure; through the agency of birds and of the wind; by means of floods and through various human agencies. Weeds new to the country are constantly being found; only lately two new kinds were recorded from the Liverpool Plains; both useful adjuncts to our list of winter fodder plants. One

plant was, however, lately recorded from this district which is parasitic on grass roots—yellow rattle, which has nothing to recommend it.

All our weeds are not introductions from aboard; some are native to the country, and are becoming plentiful in our paddocks; for example, Cotula, a small composite and a milk tainter; whilst we have a large series of native plants injurious to stock.

Eradication of Weeds.

To you more interest perhaps attaches to the question of treatment, if any can be advised, in connection with getting rid of weeds. I must candidly confess I have nothing fresh to give in this way. No process is yet known by means of which we can readily do away with weeds. But there are some few points which may be briefly considered to advantage in this connection.

Every farmer recognises the necessity for keeping weeds down, and in his own way does something to that end; but usually not knowing the reputation of new comers, frequently loses an opportunity of stamping out what later becomes a nuisance. How many men go out of their way a few yards to chip a weed out, or even a small patch—and thus prevent a particular weed from spreading—except it be in the course of this work in their cultivation paddock? I know patches of certain weeds that it would be a distinct benefit to obliterate—of Chamomile, Stramonium, and Prickly Pear for instance. In Richmond it may be noted the authorities are actively engaged in cutting down all noxious plants, thistles and Bathurst Burr chiefly. If we consistently cut out the early visitors, we have a chance to prevent serious invasion.

There is every reason one might say for weeds spreading. Our farmers give no time for their eradication. I mean specially in corners and along selvedges of paddocks, on the roads, along the river banks, and in grass land. It is of course a tremendous task, and if time and labour are not given to it, under our conditions it is difficult to spare them. It is a distinct disadvantage to us in fighting weeds that we have no rest from cultivation here. Crops can be grown the year round; there is no period of "no-outside-work," like the English winter, when the farmer takes his spud with him in his walks; cuts up his weeds, trims his hedges, and clears out his ditches.

The means we have at our disposal for coping with any special weed manifestation are numerous. Briefly, we may arrange weeds for practical treatment, into—(*a*) Such as can be left alone, being of no special account, or because we can hope to do nothing in getting rid of them, as the small things in grass land; (*b*) Such as we must, and do, keep down by regular cultivation; (*c*) Such as for some reason are specially noxious; as poison or tainting plants (like the wild carrot), or permanent denizens like prickly pear and sweet briar, and such as occupy ground wanted for better things (as thistles and burrs in grass land.)

Of groups *a* and *b* nothing need be said; but of the third group *c*, which falls outside such as come within our reach in the ordinary

processes of cultivation, it may be said that some special method must be adopted for their extermination according to the special needs of the case.

In eradicating weeds we need to note whether they are annuals or live longer than one year. In the former case prevention of seeding

Sorrel.

Rush.

eventually kills them out. The longer-lived ones are more difficult to deal with; prevention of seeding, however, gradually reduces their numbers. Always remembering the labour involved, the following methods may be resorted to as found convenient. Applications of arsenite of soda (cost 4½d. per lb. in bulk), 1lb. in 1 gallon of water.

This kills most weeds at least to such extent that the stumps (as in prickly pear) can be got at after burning off the dried-up plant. Salt in boiling water is a cheap and certain weed killer; as is boiling water alone for succulent plants.

I have killed Lantana by cutting down and applying sulphuric acid to the stump; waste material after use in the dairy can be put to this special work: new it costs 3d. per lb. Pulling up such plants as Paddy's lucerne every season before seeding soon clears them away: this is most readily done after rain. Sulphate of iron (cost 7s. 6d. per cwt. in bulk), 1lb. in 1 gallon of water will kill green leaves and many plants; and is specially useful for exterminating dodder: it can be applied with a watering can.

In chipping the hardy perennials, care should be taken to cut below the crown; a most important point, for above it the plant has power to develop new beds; and, consequently, if cut off high 20 stems may appear where there was only one; so cut low should be the rule. The old fashioned spud is useful for this purpose, it consists of a strong chisel blade with 1¾ or 2 inches cutting edge fastened on to a light strong handle in the same manner that a spade blade is fastened on to its handle.

Speaking generally then, do not allow weeds to seed, and do not allow them to digest food or breathe; therefore prevent leafing and flowering, and do not allow them to establish a foothold.

Judicious burning may be resorted to with advantage at times. There are several reasons why it is beneficial, I only mention two. For a time at least, after burning, weeds will be scarce, as the seeds, distributed by the wind, will lie on the surface and be destroyed by the fire. At the present time in my own back paddock, I have, separated by a well-marked line, a patch burnt over carrying no weeds and fair growth of native grasses, whilst on the other side of the dividing-line is a dense mass of grass and innumerable weeds—cud weed, rush lily, and others. The other reason is that when grass is smutted, burning destroys the (spores) of the parasite, and thus tends to reduce it in quantity by preventing the infestation of other plants.

It is hardly necessary to point out that constant cultivation and *rotation*, the latter a most important thing, will help to keep weeds down. Certain weeds cling to certain crops, as darnel to cereals, false flax (Camelina) to real flax, corn-cockle to wheat.

Amongst the worst weeds to eradicate are such as have underground stems, like common sorrel and the Canada thistle; constantly bringing the parts to the surface seems to be the only thing for them.

As has been already remarked, the weeds of arable land are, generally speaking, kept down, for they are periodically disturbed and removed more or less thoroughly.

Weeds are an abomination anywhere, but there is no place where they are more likely to be neglected than in grass land, where they are often allowed to run their own course. They are naturally a severe tax on the land. It is worth while referring specially to them: They should be cut before flowering, more than once if necessary;

even weeds can only stand a certain amount of this. Spudding is a most satisfactory means for keeping them in check where the plan can be followed. It could be done on wet days when other work is not pressing, and persistence will meet with success.

Neglect to spread cattle and horse droppings will encourage the growth of weeds and make the grass rank locally. They should be scattered in any way most convenient when found desirable. Pasture is always getting weaker; we take more from it than is returned to it, consequently the grasses tend to become thinner, and the hardy weeds soon get a firm foothold.

Attention to pasture should include the weed question quite as much as any other, more especially where noxious plants, such as wild carrot (*Senebiera*) are spreading with such an evil effect on the butter industry. I would specially emphasize the importance of this aspect of the question.

Cats' Heads—bad weed in paddocks.

Birds are frequently useful as weed destroyers; many species eat great quantities of weed seeds. It is said of the tree sparrow of Iowa that it consumes 875 tons of weed seeds annually. Even the English sparrow, bad as it is, eats weed seeds. Larks, quail, finches, pigeons, and others all feed largely on weed seeds.

The worst enemy of red leg (a large Amaranth) or Boggabri here is a weevil, which burrows in the larval stage through the plant, riddling it and frequently killing it off.

Nature also helps in other ways in weed eradication. Some weeds after years of luxuriant growth disappear, their places being taken by others. It is said that the old Scotch thistle (*Onopordon*) has given way to another black thistle (*Carduus lanceolatus*); certainly

Cockle Burr.

here the former is scarce, and the latter found everywhere. It is assumed in such cases that the soil has become exhausted in relation to the particular plant disappearing.

Special value to Agricultural Societies attaching to a Consideration of Weeds.

Finally, an aspect of the question that brings you all into more active interest in the weeds, if such could be the case, is: What can you do in the matter besides the ordinary weed destruction that occurs during farm work?

There is much to be done, chiefly in three special lines of work, where co-operation would accomplish great results.

1st. Make a combined effort in the direction of trying to prevent the spread of the noxious weeds we have in the district already.

2nd. Interest yourselves individually and collectively in preventing the lodgment of any new weed in your district that is likely to be detrimental.

3rd. Plant no weed seeds.

To carry out the *first* point it is necessary to know what weeds we have, and which of them demand special attention. Several specially noxious things have newly arrived or are spreading in other districts; they need not spread here if forewarned is forearmed.

I therefore suggest that steps be taken through the members of this Society to obtain a census of the weeds of the district, where they are located, and their comparative quantity.

We shall be glad to receive at the College any collections or individual plants for identification and report, and are prepared to carry out all the necessary work in compiling the materials for such a census as is suggested. The children might be encouraged to keep their eyes open and their hands busy in getting specimens of all weeds.

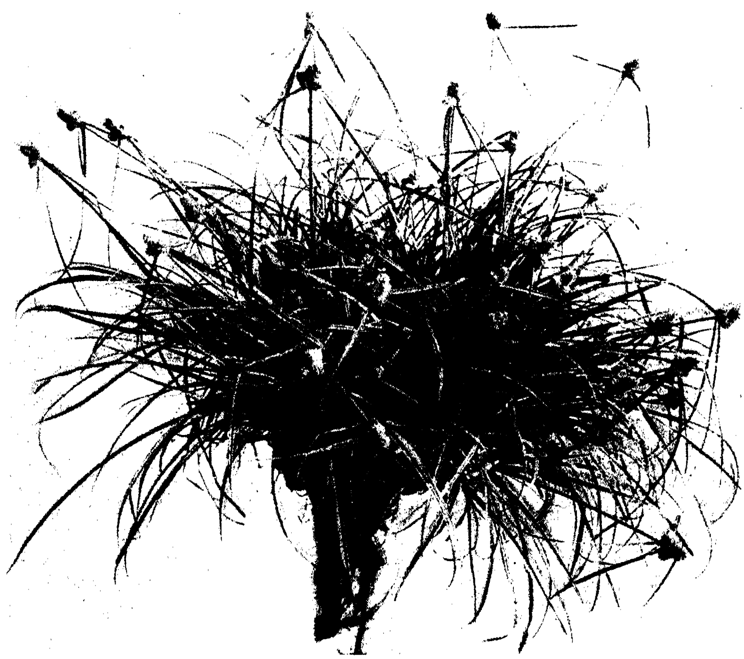
Docks.

Secondly, keep on the lookout for new things in weeds. You are the eyes and the brain of the agricultural producers of the district. Every day you look over an extensive area of land. Anything new to you should be immediately investigated as to its qualities. A dangerous enemy might thus be detected before too late, and a special effort made to get rid of it.

I know a parson in the States who wanted the fence round his church property painted. His people were not well off. They could not give much money, but they clubbed together, bought the materials, met one Saturday afternoon, and painted the fence. Why could not we do the same kind of thing to eradicate something which might be a menace to our district? No Agricultural Society should be so apathetic as

to allow the sweet briar, for example, to begin, as a few plants scattered here and there in a few years cover many hundred acres, when a few willing hands could clear off the unwelcome intruders in a few hours. In this direction good work could be done by a Society taking such steps as were considered desirable in the interests of the community, even to the extent of holding a working "Bee."

Just now we are at an interesting stage in the weed question. The drought has, in the importation of stock food, brought in many plants new to the country; it behoves us to see that nothing detrimental gets a footing here. Of all places the roads and railways should be watched, for there the aliens commonly get a first footing.

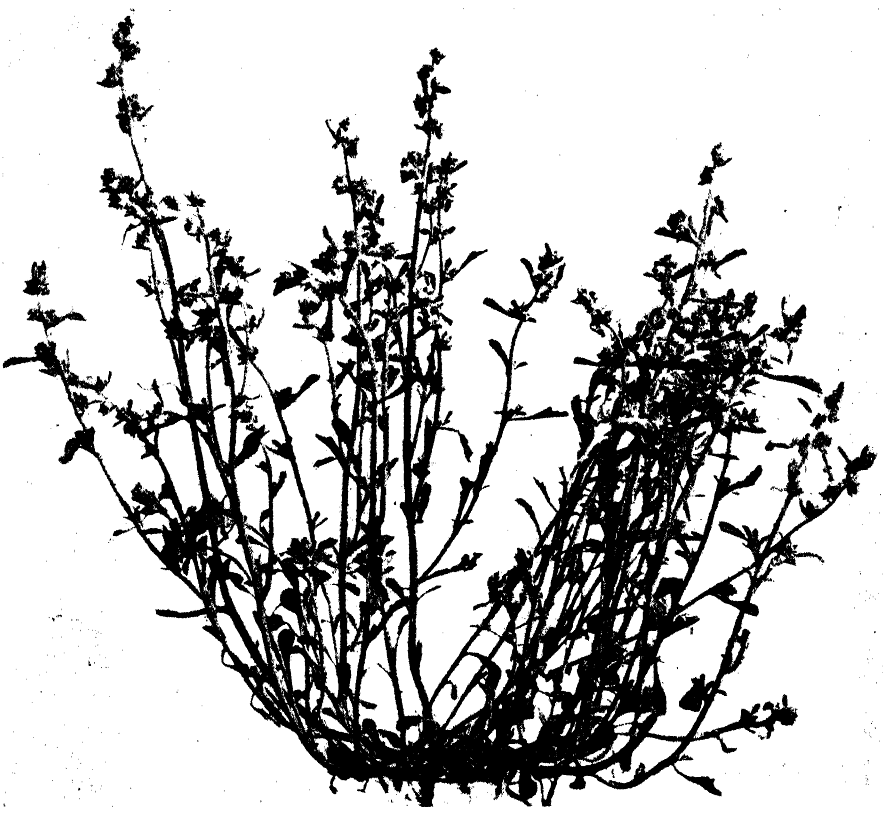


Sedge—a weed of grassland.

The third point is one of equal importance with the other two. See to it that no weed seeds are planted with your crop seeds so far as it is possible to prevent it. We recently had under investigation a sample of wheat containing a large percentage of corn-cockle seeds. Such wheat, if the weed were not got rid of, would if sown give very impure results, and with this weed-seed admixed might, if used for flour, be positively dangerous to human life. This subject engages considerable attention at the College, and any seed sent for examination will receive prompt attention and report.

Before sowing, then, always examine your seed carefully; if it contains weed-seeds, screen it and get rid of them; do not throw them out, but put them in the fire, or, better still, parcel them up and let us have them with all particulars at some convenient opportunity.

Should the Society feel disposed to act in the ways indicated I will ask permission to prepare a set of the district weeds with remarks indicating those needing special attention, for framing. Such a



Cudweed—said to produce hair-balls in stock.

framed set hung in your meeting place would form reference material which doubtless would be of great use. The Principal would be glad for you to consider that the College will act at all times in the capacity of Consulting Plant Doctor.

Bureaus for Weed and Seed matters would be an interesting and important departure from the old lines of work in such societies as yours. You would be inaugurating new work that would prove of the greatest value to members as individuals and to the district in which they are located.

Our Worst Local Weeds.

DURING the lecture members were asked to fill in circulars handed round with the names of the six worst weeds in their district, with the following result, plants being named in the order of importance they

Barley Grass—useful in early stage, but injurious when ripe on account of sharp awns.

obtained in the voting. No. 17 is at present unknown to us. No. 18 must have been evidently named as a pest of the State—not being found here.

NOTE:—The worst *weeds* may be taken to be those which give the man who has to deal with them the most trouble.

Bad Weeds near Richmond and Windsor.

Common Name.	Latin Name.	Remarks Made.
1 Bathurst Burr ...	Xanthium spinosum	Burrs depreciate wool. Good for nothing. Hard to exterminate. Injurious to grazing paddocks. A great nuisance in horses' tails and manes.
2 Nut Grass, Pig Nut	Cyperus rotundus	Bad in cultivated land. A great plant food robber. Impossible to exterminate it. Will grow through and spoil potatoes.
3 Thistles	Carduus, &c., (several species)	Useless. Spreads rapidly. In time takes complete charge of well grassed land.
4 Docks	Rumex, (several species)	Will slightly taint milk. Almost unkillable. Hard to deal with if allowed time before working through them. Useless for stock.
5 Sorrel	Rumex acetosella	Difficult to eradicate. Useless. Very persistent and rapid in growth. Chokes crops.
6 Balm, Stagger Weed	Stachys arvensis	Useless. Dangerous to stock eating it. Causes weakness in working horses.
7 Saucy Bob, Thorney Dock, Chinese Burr	Centaura calatropa	Absolutely useless. Very bad weed. Spoils hay.
8 Wild Carrot ...	Senebiera didyma	Milk tainter of the worst kind.
9 Blue Top, Mother Gunther, Cobler s pegs	Verbena bonariensis	Strong grower. Smothers all grasses. Useless for fodder.
10 Johnson grass ...	Sorghum halepense	Injures crops. Difficult to eradicate.
11 Cats' heads... ...	Emex Australis	Very bad weed. Stock will not touch it.
12 Paddy lucerne ...	Sida retusa	Although stock will eat tops, is a bad weed in grass land.
13 Dandelion	Hypocharis (2 species)	Said to produce stringhalt in horses. Smothers grasses.
14 Sweet briar ...	Rosa rubiginosa	Monopolises grass land. Difficult to get rid of.
15 Blackthorn ..	Bursaria spinosa	Monopolises grass land.
16 Dodder	Cuscuta epithymun	A lucerne destroyer.
17 Oil tree	?	Poisonous to stock.
18 Water hyacinth ...	Pontederia	Impedes navigation.

Paspalum Dilatatum.

H. W. POTTS.

The season this year has been especially favourable to the growth of this grass. So dense and prolific are they at this College that we have thought it well to illustrate three of the plots at different ages.

Plot No. 1 is near the piggery and was planted the first week of September this year, and hence is only three months old. This crop

Plot 1.—Paspalum at H. A. College.

Plot 2.—Paspalum at H. A. College.

is being cut for the pigs. They, especially the boars, eat it with great relish, and in it we find one of the most useful adjuncts to sty feeding we possess. It is cut fresh every day and thrown into the sties.

Plot No. 2 was planted in poor sandy loam in August, 1902, so that this plot is only sixteen months old. The growth here all through last summer's drought was vigorous, and a heavy crop of rich succulent feed was available in mid-summer.

Plot No. 3 has been planted two and a half years, and throughout the two years' drought give us ample evidence of its drought-resisting

Plot 3.—Paspalum at H. A. College.

qualifications. This season, when it reached the average height of 5 ft. 6 in., it was cut for hay, and gave a return of 18 tons 2 cwt. 1 qr. and 8 lb. per acre greenstuff, equal to 6 tons of hay per acre. The nutritive food value of Paspalum dilatatum is very high. Its succulence and palatability is unquestioned for any kind of stock, particularly horses, cattle, and pigs. Its richest growth is in early summer, and its succulence and greenness prevails throughout the summer. It will stand heavy stacking in summer, and provides green food when the majority of other grasses are dry, colourless, parched, and innutritious. In addition, whilst it displays a partiality for rich moist soils, our experience goes to prove that it will provide excellent fodder of great quantity on poor soils in dry areas. This season will bring into prominence the necessity for making provisions against fires in the paddocks. The luxuriance of growth in all directions points to great

dangers during the warm weather. Fire-breaks will have to be made, all entailing expense.

This brings to mind the great possibilities existing in the growth of Paspalum dilatatum to act as natural fire-breaks. Instead of ploughing long strips of land year after year, why not plough and at the same time plant Paspalum? It is always green enough in summer to resist fire, and thus we secure the dual advantage of a summer grass and a fire-break. This idea was discussed in this *Gazette* by Mr. C. Robinson, and in Victoria two years ago, and the Railway Commissioners of that State are carrying out a series of tests along several railway lines to test the value of the grass in this direction.

Farm Notes for January—Hawkesbury District.

H. W. POTTS.

There is every prospect of the maize harvest being plentiful this season, provided we are not visited with the dreaded western scorching hot winds. Last season these practically lowered the value of the crop by two-thirds. Then, however, the plant had grown rapidly, and was by no means sturdy. The conditions this season are more favourable. The plant has had an opportunity of building up a vigorous growth. The subsoil is moist, the season late, and conditions generally are distinctly on the side of a heavier yield. So far attention has been devoted to keeping down weeds and caterpillars. The latter are past the stage of effecting injury to maize now; but we still have the weeds, and shallow cultivation is constantly demanded. A more favourable season could not be desired for planting late crops for green fodder and ensilage. The soil is in excellent order, and we may look forward with the prevailing heat to rapid germination of the seed and a quick vigorous growth. Early maturing varieties are most suitable this month to plant, such as Early Mastodon, Hickory King, Red Hogan and Abercrombie. Drilling may be best effected with a Hornsby Ridging Plough, 3 feet 6 inches apart, and the grain planted with a Farmer's Friend Corn Planter. About 12 lb. of seed per acre will be sufficient. Where the land is poor, and has not been fertilised by rotation, it may be necessary to add artificial manure, about 1½cwt. per acre, two-thirds bone-dust and one-third No. 1 superphosphate. Whilst the crop is growing the most suitable method of cultivation will be to commence with rolling, harrow twice, and scuffle twice with the Planet senior or sulky scuffler, and finally hilled.

Sorghum.—The summer will deprive us of the immense quantity of green herbage and fodder so well grown during spring, and we need green food towards autumn and early winter. No crop pays so well for this period in feeding cattle and pigs as Sorghum. Moreover, it is one of the best crops for conserving as ensilage either in stack, pit

or tub. One great advantage is that it stands as a green crop right up to July, and for autumn stall feed for dairy cattle it stands unrivalled. The nutritive value of the plant stands almost equal to that of maize. We have grown Planter's Friend up to 13 tons per acre. The food is palatable, succulent, and possesses a high nutritive value. The Early Amber Cane suits this district admirably. It stands dry weather, has a high sugar value, matures early, and resists dry weather better than maize. Sorghums flourish and develop well on sandy loams. They go a good depth for plant food. The Imphee variety also gives splendid returns. Shallow cultivation is required until the young plants are well established. Special attention should be devoted to this as the early stages of Sorghum growth need stimulation. The young plants are somewhat delicate.

Millets.—Further crops of Millets may be sown this month. These will mature before the autumn frosts set in. White French matures more quickly than any other variety, and yields well both grain and flag. Hungarian and Broom Millets may also be sown.

Potatoes.—The early crops are now being harvested, and are turning out fairly well. The second or late crop may be prepared for this month. Thorough tillage is essential. The soil is in excellent condition in so far as moisture is concerned. Medium sized whole potatoes give the best results when planted at this season of the year, and those which have sprouted promise a quicker growth.

Sweet Potatoes.—Planting of this valuable tuber may be continued this month. The earlier crops will be fit to dig this month.

Pumpkins, Squashes and Melons.—These crops are somewhat late this month owing to the rains and low temperatures. Growth, however, will now be very rapid. Weeds have been very troublesome but the large leaves are begining to take possession of the ground.

Swedes and Mangolds.—Towards the end of the month early sowings of these root crops may be made with good results. The chief aim is to get the soil into fine tilth.

Green Feed for Winter.—The ground may be got ready this month for the sowing of winter and spring green crops for stock. These can be arranged to sow in February and March, such as wheat, oats, rye, barley, beans, peas, tares, etc.

Orchard Notes.

W. J. ALLEN.

January.

Whether or not it would ever be possible to give to each grower just what he considers the correct quantity of rain to suit the requirements of his individual case is a conundrum which no person in the flesh can answer satisfactorily, as wherever you go you will find those who wish either that the rain would let up for a season or those who are praying for its appearance. Next to irrigation, it is perhaps the most vexed question of the day, because while few understand the former, we all know about the latter and can discuss it understandingly. There can be no doubt however, that in many instances, the wet season has been responsible for a good deal of the damage which has overtaken many of the crops, and scab of the apple and black spot of the vines are undoubtedly flourishing under the existing wet conditions, yet I fancy there are not many of the stock-owners who are complaining of the over-luxuriance of the growth this season.

The season has not only been wet but it has been cool, and while those engaged in strawberry culture have little to find fault with, those engaged in growing apples, grapes, oranges, and peaches are compelled to fight the various fungus diseases with unceasing energy. As above stated there is considerable black spot or apple scab on some varieties of apples. The Granny Smith appears to have suffered the most, while we find the 5-Crown Pippin fairly immune from it. I have visited orchards where, owing to the presence of this disease, the crop will only amount to about a quarter of what is usually harvested, and it is found that those trees growing in the lower levels are the worst sufferers. If the advice given in these notes from month to month had been followed and the trees sprayed in the spring and again after the fruit was well set, the loss from this disease would not have been anything like so great. In our Bathurst orchard, where we have a good many apples growing, we have not lost any fruit through scab, not even the Granny Smith, but the trees had all been well sprayed, which accounts for their good condition.

I regret to say that in most of the cooler districts the peach crop will be a failure, owing I fancy to the very cool nights in the early part of the season.

In many places the oranges did not bloom well, more particularly the seedling varieties, and in consequence the crops will be light in these places, while in other districts the crops of this fruit are the heaviest for years.

It is well to keep the orchards thoroughly cultivated and free from weeds; this, of course, does not apply to those on steep hillsides in districts where the rainfall is heavy throughout the summer.

Where apples are growing see that the bandages are looked at regularly, and all moth-infested fruit picked up and boiled or fed to pigs; and it is not too late to give the tree a spraying with arsenite of soda or Paris Green to help keep the Codlin Moth in check, as at this season of the year it will be found very active, and the orchard must receive every care if the grower expects to harvest much clean fruit. In every apple-growing district which I visit five out of every six growers are praying for a Pests Bill, and say they will never do well until they get it.

At time of writing these notes it is too early to say whether we will be troubled with the fruit-fly, but should it make its appearance see that all fly-infested fruit is picked up and boiled, so as to keep this pest under as much as possible.

Wherever a tree is found growing too thick it might with advantage be thinned out, cutting back the superfluous growth to within three inches of the main branches, so as to encourage it to develop fruit spurs in the proper place. Trees found going to wood and not bearing may be headed in, thus lessening the winter's pruning to a certain extent, and at the same time helping the tree to throw out fruit buds.

Some of our best drying varieties of peaches will ripen towards the latter part of this month, and I advise those who intend drying any to see that they are thoroughly ripe before they are picked, then cut in halves and placed in the fumigator for two or three hours. If dried in the sun see that they are kept free from dust, as nothing damages the newly-cut fruit so much as a coating of dust. Early Crawford and Elberta peaches make excellent bottled fruits, and for those who intend to process them in this way I would recommend the use of these varieties. A good syrup is made by mixing 4 lb. of best brewers' crystals to the gallon of water. After boiling for twenty minutes, strain and allow to cool, then having peeled, halved, and packed the jars tightly with the fruit, fill up the bottles with the cold syrup; place the tops on the bottles, but not the rubbers, then place them in a copper, arranging them so that they can neither touch the bottom, sides, or each other, using either strips of wood or cloths for the purpose. Fill the copper with cold water to a depth of three-quarters the height of the jars, and light the fire under the copper. After the water comes to a boil, cook for from 20 to 30 minutes, according to ripeness of the fruit, then remove from the copper and fill each jar to overflowing with boiling syrup kept on one side for the purpose. Put on the rubber rings and screw on the tops, and allow to cool slowly before storing in a cool place.

See that all fruit intended for market is well graded and packed so as to present a good appearance when opened up. If the variety is inclined to be soft and easily bruised, pick a little on the green side so that it will not be over-ripe and bruised when it reaches the consumer.

American fruits have landed in Sydney in good condition during the last few months, the plums and peaches being packed similarly to eggs, and in such a manner that it was almost impossible for them to become bruised in transit. The principal fruits imported were apples, peaches, plums, pears, and grapes.

Practical Vegetable and Flower Growing.

W. S. CAMPBELL.

Directions for the Month of January.

Vegetables.

Favourable conditions for vegetable growing seem likely to continue during January, and in all probability, unless some sudden change takes place, the present summer will probably be the mildest experienced for many years. The occasional showers keep the ground sufficiently moist for vegetable requirements, and no farmer can have an excuse for being without an abundant supply of these necessaries, for, during such a season, the growing of vegetables is a comparatively easy matter, the most difficult work in some localities being the prevention of the growth of weeds, which run up so rapidly as to outgrow and injure, and, perhaps, destroy young vegetables unless the weeds are removed in time.

Pull up everything that is not likely to be productive or profitable, such as old peas, beans, cabbages, and other vegetables which have run, or have started to run, to seed. Strawberries, which are generally grown in the vegetable garden, are likely to send out runners from all sides, and if some good plants are required for putting out in new beds next autumn, take the opportunity of selecting the best of the suckers, which will probably be found next to the mother plants, and in removing all others. As soon as the suckers have become well rooted, separate them from their parents by cutting the connecting links. Should the weather continue favourable, the young strawberries, if nicely rooted, may soon be planted out, without waiting for the autumn, and it is quite possible that some of them may bear fruit before the winter sets in. When planting, or, rather, after planting, tread the soil well about the roots and spread a mulch of dung all around the plants, as it is quite possible that some hot, dry weather may set in after all; although there may be a risk in planting, it is worth chancing, for so much time may be saved.

Beans.—Any kinds, except the Windsor, or broad bean, may be sown as extensively as may be required. It would not be advisable to sow beans on the same ground from which beans of any kind or peas have just been removed. It would be much better to try cabbage, or, better still, some roots, such as carrot or turnip, and the soil would have a complete change. By constantly growing the same kind of vegetable, or vegetables belonging to the same natural order, as it is called, on the same piece of ground, not only does the soil become

"sick" of them, but vegetable pests, insects and fungi, which are common to the natural order, have a much better chance of thriving and increasing than would otherwise be the case. Try some of the runner beans, if sticks or other supports can be provided for them. These can be sown either in single or in double rows, about a foot or so apart. The little labour entailed in fixing up supports should not deter anyone from growing a few rows of these beans.

Broccoli.—Sow a little seed of this vegetable, which is much the same as cauliflower, but rather coarser and hardier than that variety of cabbage. Like the cauliflower, it requires good, moist soil, well drained, and it is always advisable to use a good quantity of manure and thoroughly incorporate it with the soil when preparing for planting. This vegetable should be grown without a check if possible.

Borecole, or Kale.—This is a good vegetable, but, strange to say, but little grown in this State. It is worth a trial, particularly by those who live in the cool parts of the country. This is another member of the cabbage family, and needs much the same management as cabbage, applying abundance of manure to the soil, unless it be naturally very rich. Sow a little seed.

Cabbage.—Sow seed occasionally—just a little—in order that a supply of plants may be available for pricking out, and for planting whenever required. Sow the seed in drills, in a small seed bed, quite thin. The generally adopted but erroneous method of sowing cabbage seed is broadcast, as thick as possible, with the result a miserable lot of lanky-looking plants, to be hauled out by the handful when required for planting. Mr. Ellis, of the Viticultural Station, Howlong, finds that the variety known as Phenomenal succeeds best if sown during January. Well-grown plants which are ready should be planted out.

Cauliflower.—Treat as recommended for broccoli. The seed may not, perhaps, come up so well as the broccoli, for it is a difficult matter sometimes to procure good cauliflower seed. It is worth while paying top price for the small quantity that is likely to be required.

Cucumber.—Seed may be sown in any part of the State if plants are required, and during such a season as the present the growth of the cucumbers should be most satisfactory.

Celery.—This should be growing very well under the favourable weather conditions lately prevalent. Sow a little seed. Prick out advanced seedlings, and plant some of the pricked out well-grown seedlings. Earth up any plants which are nearly full grown, taking care not to drop any soil within the leaf stalks.

Cress and Mustard.—Sow occasionally during the month to keep up a supply. These salads should attain great perfection with showery and cool weather.

Egg Plant.—Probably a sufficient supply of seedlings have been planted. But should any more plants be required, sow a little seed, which should soon come up after sowing.

Maize (Sweet or Sugar).—Advanced plants should be sufficiently well cultivated to keep down all weeds. More seed may be sown if a further supply is required.

Onion.—A little seed may be sown if an additional supply be required. Seedlings which are coming up above ground should be kept quite free from weeds. The weeding must be carefully done or the little onion plants may be pulled up with the weeds if they are thick. In small vegetable gardens the system of sowing onions for transplanting is a good one, and if carried out a good deal of trouble may be saved in the way of weeding, seed sowing, &c. The seed can be sown in small beds, or in boxes if this should be more convenient, and when the onions are large enough to shift they may be planted out. If the soil is at all dry, the onions should be well watered after planting.

Parsley.—A little seed may be sown if there are no plants in the garden.

Peas.—The season is all that could be desired for the pea. It will probably be found that the vines have grown much taller than usual, and, unless sticks have been provided sufficiently tall, the peas have grown into a tangle. Those vines which are allowed to grow over the ground are even worse, and are liable to rot and die off, and a good deal of loss is the consequence. Some kind of support should always be provided for peas and other climbing vegetables. A few seeds may be sown two or three times during the month, or when space is available.

Potato.—Plant out a few rows of this most useful vegetable. Use abundance of farmyard manure, and mix it well with the soil as digging is proceeded with. When planting, try spreading a good layer of dung along the bottom of each trench, and plant the potatoes on the dung. Give the plants ample space in which to grow. The rows may be made from 2 feet 6 inches to 4 feet apart. Lay the sets about 1 foot apart in the rows, and let them be covered about 5 or 6 inches deep with soil.

Pumpkin.—The plants should be spreading well over the ground by this time; but should a sowing have been overlooked, seed may be planted at any time convenient, and a good crop is likely to follow.

Radish.—Sow a little seed now and then to keep a supply going.

Spinach.—Sow a little seed.

Tomato.—If any more plants are required, seed may be sown, or seedlings already suitable for moving may be planted out. There should be a good show of fruit by this time in many parts of the State. Plants which have been allowed to spread over the ground are not likely, during a moist season such as the present, to ripen their fruit satisfactorily; they should be trained to stakes or other kinds of supports. There are various methods of training adopted by different growers. Some train to a single stem, pinching off lateral shoots as they start into growth; others train, allowing the lateral shoots to develop, and so on.

Flowers.

There should be no want of flowers during the month if the present favourable weather conditions continue. Such a remarkably favourable season is most unusual, especially as, so far, there has been an entire absence of hot winds.

The foliage of many of the spring flowering bulbs is dying down, and as soon as it turns yellow it may be removed; and later on when the bulbs are quite at rest they may either be taken up and stored away in dry sand or allowed to remain in the ground without disturbance. Some of the tender varieties of annuals may be planted quite near these bulbs in order to fill up the gaps caused by the disappearance of the foliage.

Carnations of the perpetual flowering kinds, which are blooming well at the time of writing, are likely to continue to produce many flowers during the month. The Marguerite class will also probably be flowering well.

Dahlias are already flowering well in many gardens, and so far are producing good blooms. During January and afterwards there is likely to be a fine display. The old type of dahlia is giving place almost entirely to the cactus varieties, which are extremely pretty and useful. The single kinds, too, are much in favour, and are extensively grown by some gardeners. Both these dahlias may easily be raised from seed, and plants will produce flowers the same season. Should caterpillars be causing damage to any of the garden plants, spray the plants with Paris green and lime. Mix the Paris green with water, at the rate of 1 lb. Paris green with 160 gallons of water, and a handful of lime. Mix this thoroughly and strain for use.

Roses may be planted from pots, if good pot-grown plants which are not old and pot-bound can be procured. These are generally kept in stock by nurserymen, and probably many varieties are available. Should the soil not be moist at time of planting use plenty of water, and mulch with farmyard manure.

Remove all seed-vessels from flowering plants, such as roses, dahlias, verbenas, bouvardias, and others, and the plants will soon produce more flowers.

Dairy Shorthorn Herdbook.

Owing to want of space in this issue the report of the Conference convened to discuss the establishment of a Dairy Shorthorn Herdbook has been held over, and will appear next month.

AGRICULTURAL SOCIETIES' SHOWS, 1904.

Society.	Secretary.	Date.
Dapto A. and H. Society ... ... (Acting Secretary)	W. E. Faulkner...	Jan. 13, 14
Albion Park A., H., and I. Association	H. Fryer	,, 20, 21
Gosford A. and H. Association	W. McIntyre ...	,, 22, 23
Kiama A. Association	J. Somerville ...	,, 26, 27
Wollongong A. and P. Society	J. A. Beatson ...	,, 28, 29, 30
Luddenham A. Society	J. M. Blake ..	Feb. 9, 10
Moruya A. and P. Society	J. Jeffery ...	,, 10, 11
Manning River A. and H. Association (Taree) ...	S. Whitbread ...	,, 11, 12
Ulladulla A. and H. Association	Jos. Kendall ...	,, 17, 18
Alstonville A. Society	F. H. Bartlett ...	,, 23, 24
Candelo A. Association	C. A. Brooks ...	,, 24, 25
Tumut A. and P. Association	Bland Clayton ...	,, 24, 25
Lithgow A., H., and P. Society...	H. N. Tolliffe ...	,, 24, 25
Campbelltown A., H., and I. Society	A. R. Payten ...	Mar. 1, 2
Tenterfield Intercolonial P., A., and M. Society ..	F. W. Hoskin	,, 1, 2, 3
Bega A., P., and H. Society	John Underhil ...	,, 2, 3
Lismore A. and I. Society	T. M. Hewitt ...	,, 2, 3
Newcastle and District A., H., and I. Association ...	M. A. Fraser ...	,, 2, 3, 4, 5
Robertson A. and H. Society	R. G. Ferguson ...	,, 3, 4
Port Macquarie and Hastings Dist. A. and H. Society	J. Y. Butler ...	,, 3, 4
Castle Hill and District A. and H. Association ...	R. H. Lalor ...	,, 8, 9
Glen Innes and Central New England P. and A. Association	Geo. A. Priest ...	,, 8, 9, 10
Bombala Exhibition Society	R. H. Cook ...	,, 9, 10
Tumberumba and Upper Murray P. and A. Society ..	Jack J. McAlister	,, 9, 10
Crookwell A., P., and H. Society	C. T. Clifton ...	,, 11, 12
Cobargo A., P., and H. Society...	T. Kennelly ...	,, 16, 17
Clarence P. and A. Society	Jas. C. Wilcox ...	,, 16, 17
Blayney A. and P. Association	H. R. Woolley ...	,, 16, 17
Camden A., H., and I. Society	C. A. Thompson	,, 16, 17, 18
Goulburn A., P., and H. Society	J. J. Roberts ...	,, 17, 18, 19
Gundagai P. and P. Society	A. Elworthy ...	,, 22, 23
Mudgee A. Society	J. M. Cox ...	,, 22, 23, 24
Warialda P. and A. Society	W. O. Geddes ...	,, 23, 24
Cooma P. and A. Association	C. J. Walmsley ...	,, 23, 24
Liverpool Plains (Tamworth)	J. R. Wood ..	,, 23, 24
Cumnock P., A., and H. Society	W. L. Ross ...	,, 23
Macleay A., H., and I. Association	E. Weeks ...	,, 23, 24, 25
Nepean District (Penrith) A., H., and I. Society ...	E. K. Waldron...	,, 24, 25
Quirindi District P., A., and H. Association	Geo. Haughton ...	,, 27, 28
Molong P. and A. Association	C. J. V. Leathem	,, 30
Royal A. Society	F. Webster	Mar. 30 to April 7
Bathurst A., H., and P. Society	W. G. Thompson	Ap. 13, 14, 15, 16
Hunter River (West Maitland) A. & H. Association...	W. C. Quinton	,, 19, 20, 21, 22
Orange A. and P. Association	W. Tanner ...	,, 20, 21, 22
Upper Manning A. and H. Association..	W. Dimond	,, 28, 29
Moree P. and A. Society	S. L. Cohen ...	May 3, 4, 5
Dungog A. and H. Society	Chas. E. Grant ...	,, 4, 5

[6 plates.]

Agricultural Gazette of New South Wales.

Milk Fermentations.

M. A. O'CALLAGHAN.

THE USE OF BORIC ACID AS A PRESERVATIVE IN NORMAL MILK, CONDENSED AND CONCENTRATED MILKS.

As this question is engaging considerable public attention just now, the following notes, which I have made as a result of several experiments, should be of interest. Most of the opinions I have heard expressed on this subject are the result of experiments on normal milk only. To apply deductions from such experiments to condensed and concentrated milks may lead to false conclusions. The fermentation of normal milk is one thing; the fermentation of condensed and concentrated milks is quite another matter.

Some Conclusions as a Result of many Experiments.

(1.) Concentration is in itself a powerful preventive to the rapid development of many varieties of bacteria. This is due to two causes:—

(*a*) The high amounts of solids in proportion to water; and
(*b*) To the fact that almost all bacteria develop much more slowly in a milk that has been subjected to a high temperature than in a normal milk.

(2.) Boric acid in small quantities (see table) has very high inhibitive powers on some species of bacteria, and little, if any, inhibitive powers on others. For instance, ·25 and ·50 per cent. boric acid in new milk checks very materially the development of lactic acid bacteria, while these percentages do not appear to retard in the slightest butyric fermentation. This latter fermentation is, however, accompanied by a very offensive smell and taste.

(3.) Concentration combined with the use of between ·25 and ·50 per cent. of boric acid (or more) appears to check the growth of nearly all bacteria, and to completely alter the actions of many varieties that even grow therein. It is very difficult to develop lactic fermentation in such milk.

Butyric fermentation will develop but slowly. An organism that causes normal milk to become rapidly stringy or ropy, and which has a similar effect on new milk to which ·5 per cent. of boric acid has been added, has also the same powers in unsweetened condensed milk, but in *concentrated* milk containing ·4 per cent. boric acid this action is not observed. This is a remarkable illustration of the combined preservative powers of concentration and boric acid (·4 per cent.). The inability of *B. Fluorescens liquefaciens*—a micro-organism that

peptonises ordinary milk very rapidly, elaborating offensive products—to peptonise concentrated milk is also a striking example of how this species of organism is held in check by concentration.

The table given herewith shows the inhibitive powers of boric acid in varying quantities in milks differently treated. Most of these milks preserved with boric acid showed the presence of butyric fermentation long before coagulation was complete.

(4.) Some gas-forming bacteria are not affected either by concentration or by ·5 per cent. of boric acid, or by both combined; and this is, as a consequence, the most dangerous form of fermentation to the manufacturers of condensed and concentrated milks.

See photographs, which show how a concentrated milk was affected when attacked by two organisms, one of which coagulated it while the other formed gas. In a case of this kind, it is the manufacturer that would suffer. Such milk would not be placed before the consumer, because its appearance would render it unsaleable. If put up in sealed tins the ends of the tins would probably burst.

(5.) A vigorous lactic acid fermentation inhibits the growth of many varieties of micro-organisms, but it would be incorrect to say that it prevents the growth of all putrefactive organisms. Some species develop rapidly and side by side with *B. Acidi lactici*, including many gas-forming bacteria.

(6.) As small percentages of boric acid in normal milk only inhibit the growth of the less resistant bacteria, allowing at the same time many objectionable species to develop, it cannot be recommended as a preservative in new milk.

The photographs given illustrate these conclusions.

TABLE showing time (in hours) taken by various milks to coagulate.

Date of Experiment.	Percentage of Preservative (Boric acid).					Remarks *re* Class of Milk used, &c.
	Nil.	·25 per cent.	·50 per cent.	·75 per cent.	1·00 per cent.	
A. 8 Oct., 1902	24 hours	41 hours	100 hours	120 hours	160 hours	Pasteurised separated milk. Room temperature, 68 deg. to 75 deg. Fahr.
B. 23 Nov., 1902	12 ,,	36 ,,	68 ,,	132 ,,	228 ,,	,, ,,
C. 28 Jan., 1903	48 ,,	......	96 ,,	......	240 ,,	Sterile milk to which a pure culture of lactic acid bacteria was added. Room temperature about 72 deg. Fahr.
D. 1 Feb., 1903	2 days..	2 days	2 days	......	......	Sterile milk to which a pure culture of lactic acid bacteria was added. Room temperature, 75 deg.
E. 5 ,, 1903	20 hours	......	......	120 hours	260 hours	Sterile milk to which a pure culture of lactic acid bacteria was added. Room temperature, 68 deg. to 77 deg.
F. 20 Oct., 1903	30 ,,	125 hours	......	......	......	Unheated milk. Temperature, 61 deg. to 75 deg. Fahr.

This milk was supplied by a North Sydney dairyman at my house in the ordinary can. The boric acid was added immediately after delivery, or about two hours after milking. Coagulation was extremely slow, because, aided by the boric acid, other bacteria almost crowded out the lactic acid species.

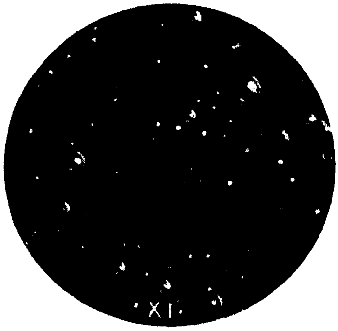


Fig. X 1.—Sample obtained from a city delivery cart, and which was unpasteurised (not heated above 173° F.), and contained no preservatives. Plate made on arrival at laboratory, 10 a.m., 22/9/03. *B.A., lactici, B. Fluor. liq. present.*

Fig. Y 1.—Plate culture made from a sample of city supply milk, obtained from cart. Plate made at 10 a.m., 22/9/03. Sample contained no preservatives, and was unpasteurised (not heated to 173° F.) The plate contained lactic acid bacteria, and some liquefying colonies of a bacterium (*B. Fluorescens liquefaciens*).

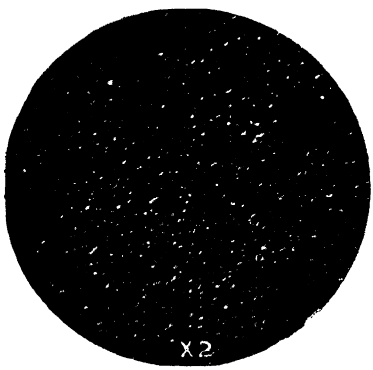


Fig. X 2.—Plate from same sample—12·30 p.m., 23/9/03—showing large increase in number of liquefying bacteria, especially *B. Fluorescens liquefaciens.*

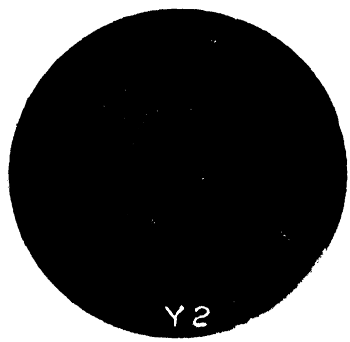


Fig. Y 2.—Plate culture from the same sample; 12·30 p.m., 23/9/03. Bacteria very numerous; liquefying colonies numerous. (*B. Fluorescens liquefaciens*).

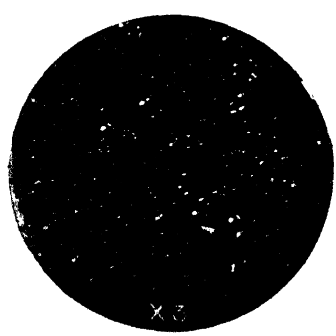


Fig. X 3.—Plate from preserved sample of same milk (·25 boric ac.); 23/9/03; *B. Fluorescens*; butyric bacteria and lactic bacteria.

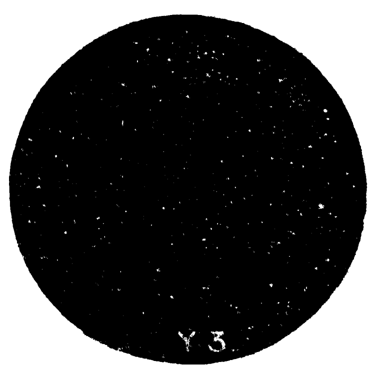


Fig. Y 3.—Plate culture from a sample of the same milk, to which ·25% of H_3BO_3 was added on arrival at the laboratory. Plate made 23/9/03. Numerous colonies of liquefying and non-liquefying bacteria; also a number of *B.A. lactici.*

Bacteriological condition of city supply milk.

Fig. Z 1.—Plate made on arrival. Colonies of *B. Fluorescens liq.* and colonies of lactic bacteria, and a few atmospheric organisms.

Fig. Z 2.—Plate made from same sample, 12·30 p.m., 23/9/03; colonies of *B. Fluorescens liq.*, and lactic bacteria.

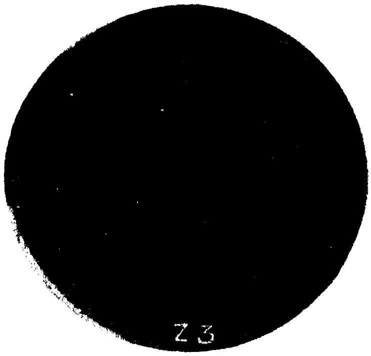


Fig. Z 3.—Plate from some of the same milk preserved with ·25% boric acid. Plate made 23/9/03. Large numbers *B. Fluor. liq.*

Bacteriological condition of city supply milk, obtained from a morning delivery cart. Sample unpasteurised (not heated above 173° F.) and unpreserved.

Fig. Z 4.—Plate made on arrival, 10 a.m., 15/9/03. Colonies of lactic bacteria. *Bact. Zopfi*; *B. Fluorescens liq.*

Fig. Z 5. Plate: 10 a.m., 17/9/03. Numerous colonies of *B. Zopfi* and lactic bacteria.

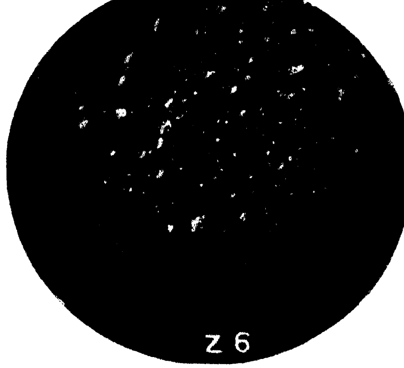


Fig. Z 6.—Preserved sample same milk; ·25 of one per cent. H_3BO_3; plate made 10 a.m., 17/9/03, showing numerous liquefying colonies, principally *B. Fluorescens liquefaciens*.

Cultures from a city supply milk, which contained no preservatives, and was unpasteurised.

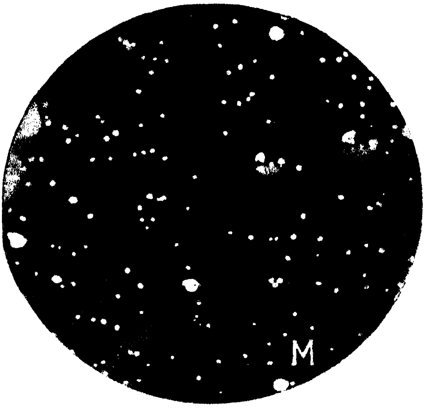


Fig. M.—Plate made on opening tin, 5/10/03. Bacteria not very numerous; mainly yellow atmospheric cocci; some colonies of a small yeast.

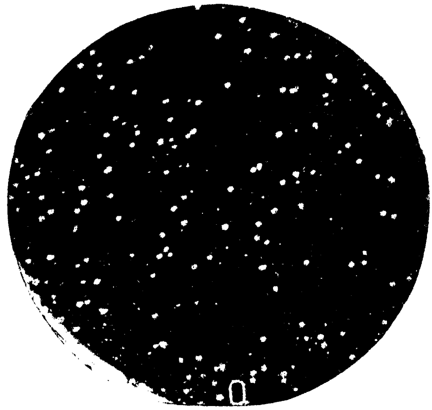


Fig. O.—Plate from same tin, 15/10/03. Only one organism present in this plate, viz., the yeast mentioned above. This organism grows in milk without causing any apparent change in it.

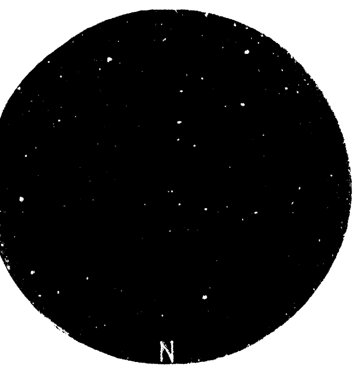


Fig. N. Plate from the same tin, which had been left open in a clean room, 10/10/03. Fair number of colonies; no liquefiers. The number of yeast colonies has increased considerably.

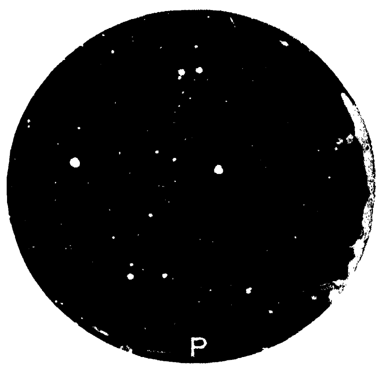


Fig. P.—Plate from same tin, 17/10/03. Only yeast colonies present.

Gelatine plate cultures from concentrated milk (containing H_3BO_3, ·29 %).

The number of bacteria in the plates is in itself of little consequence, because a milk may contain myriads of bacteria of a perfectly harmless nature, both from a fermentation and from a health point of view.

All liquefying bacteria must, however, be regarded as injurious from a fermentation standpoint, and an increase in the number of liquefiers means an increase in the amount of the undesirable product elaborated by the bacteria during their growth in milk.

Some of the milks examined in connection with these experiments were pasteurised, and some were partly pasteurised, and yet these milks contained many bacteria capable of setting up offensive fermentations. The keeping quality of the milk was therefore not

improved, and the expense gone to in pasteurising was a waste. Why? Because the treatment of the milk after pasteurisation was not of the proper kind. The water used for washing the cans was accountable, I have no doubt, for the bulk of the trouble. It is useless to pasteurise milk unless the room in which it is kept, and the cans in which it is sent out, are extremely clean. In butter making, things are different. Immediately after pasteurisation and cooling a culture of lactic acid bacteria is added; these then predominate and crowd out any stray bacteria that gain access afterwards.

Cans in which pasteurised milk is delivered should be steamed or scalded, and then allowed to cool without having recourse to cold water, because the cold water may be the means of introducing undesirable germs.

The Cold Storage of Fruit.

(Continued from p. 1198, Vol. XIV.)

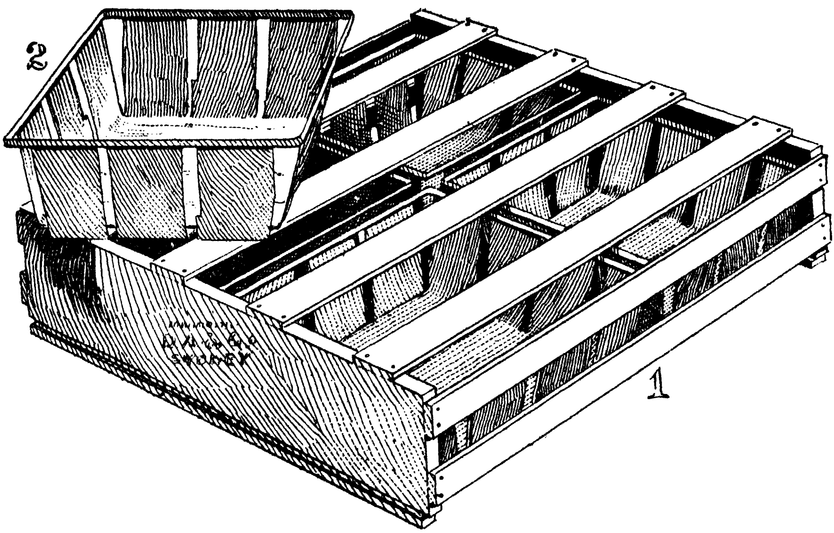
G. BRADSHAW.

"Cold storage has no creative power, it does not create wealth, it preserves it and prevents it from becoming loss. It has no regenerative magic; it cannot bring back to a good condition that which is already spoiled, but it can keep what is put into it in a practically unchanged condition for a long period of time. It has three chief uses in commerce, to preserve commodities and thus avoid direct loss, to prolong the marketing season or seasons of consumption, and to enable the trader to choose his own time for buying and selling."—PROFESSOR J. W. ROBERTSON.

OWING to the limited space in December issue but scant reference was made to grapes. The purport now is to show that although equally perishable with any, this fruit lends itself most readily to the influence of cold air, and can not only be held many months in a practically unchanged state, but can be transported many thousands of miles from the place of its origin or growth with perfect safety, and disposed of there in a condition little changed from that in which it was gathered from the vines. These claims are in no way exaggerated, conclusive proofs of them being in evidence in almost every fruiterer's shop in Sydney during the last four months of the past year, and even at the time of writing there are in the Agricultural Department's cold chambers samples which were gathered in the Californian vineyards in July or August, travelled over many miles of railway in that State, which is half the size of New South Wales, stored for a considerable period awaiting shipment to this country, bore all the risks of handling, and consequent risks to injury, at railway stations, wharves, &c., and after all this were exposed in a King-street shop window for two or three weeks, re-stored and continue sound.

I have previously shown how so much depended on the construction of the case for the safe carrying of the stone fruits, and that in which the grapes arrive is worthy of note. In the stone sorts I have shown how each fruit had a separate cubical cell, wherein it was clothed with the cold air, the cardboard walls obviating friction and keeping one fruit from touching another. The nature of grapes precluded any adaptation of this principle, as the berries could not be treated singly. The apparent difficulty was, however, overcome by the Yankees, the case adopted being practical from every point of view, and, as briefly as can be explained, is as follows:—Those connected with the strawberry business are aware of the small box used for holding a pound or approximately a quart, and termed punnets. The difficulty in applying these to grapes, is the fact that the bunches would have to be divided to allow a pound in each box. This trouble was got over by the adaptation of a larger punnet which holds 6 pounds. These are capable of holding bunches large enough for safety in transit. They are neatly made of a thin wood shaving and bound on top edge and corners with a light metal, with several small openings on the

sides to allow the current of cold air to circulate. The boxes are square, and measure 8 inches each way on top, tapering down to $6\frac{1}{2}$ inches at bottom. Four of these boxes when placed side by side



1, a Californian Grape Case; 2. a 6 lb. Grape Punnet.

form a square, the contents of which are 24 lb. They are then enclosed in a stronger case for transport purposes, the package being neat, adaptable, and scientifically correct for ventilation purposes and avoidance of friction.

Reverting to a prevailing idea of stored fruit losing its flavour through the influence of the cold, or the length of time held over, my opinions have already been expressed on the subject, but if confirmation were wanting there could be no higher court of appeal than Dr. Cobb, who has travelled America over, and has eaten the Californian fruits in the orchards of that State, and also the same country's fruit in Sydney. The Doctor's opinion is that the Californian fruit is not so well flavoured as our own, the orchardists of that State paying more attention to the keeping qualities o their fruits than the flavour. The sorts best adapted for transportation are those most plentifully grown. Dr. Cobb does not assert that the fruit of every bush and tree of that country is inferior to ours in flavour, but rather to the effect that the Californian orchardists had forethought enough to realise that the time would come when they could not consume all their own production and wisely provisioned that the safest varieties to cultivate would be those with acknowledged keeping qualities, fine flavour being an after consideration. This fact is also further testimony to the importance of my proposal of local storing to prolong the season, so that in place of our four or five months' glut and sacrifice, and a six or seven months' fruit famine, relieved by consuming the flavourless Californian sorts

or other importations, we could have our choicest kinds of almost every variety, three hundred and sixty-five days in the year. The advantages of such a system being put into operation would be manifold to the grower by the prevention of gluts, to the wholesale and retail dealers who will virtually have no dead season, and to the consuming community who will be able to purchase all the sorts independent of time or locality.

That there will be gluts the present season there is not a shadow of doubt, the entire press agreeing on that subject, and all hoping for some way out of the wood. The *Daily Telegraph* lately stated that the vineyards never looked better, &c., and showed that only for the vexatious restrictions imposed by the New Zealand Government our penny a pound grapes would be worth 6d. could they be marketed there. Hence with the New Zealand market closed, and most of the States producing enough for their own wants, the outlook for this year and others to come is the reverse of bright, for despite jam factories, pulp speculators, and other attempted means of absorption, the markets will for a few months be in such a state of over-supply as to spell disaster to the growers, and should the expectancy of a series of good years be realised the surplus trouble will be more accentuated, leaving only one solution to the fruit problem—that recommended by the *Times*, cold storage, intelligently applied, and as it has saved the industry in other countries, the same means of salvation can be utilised here. Had the present and previous article been written prior to the successful importation of Californian fruits, the practicability of the thing might have been seriously questioned, and even yet there may with a few be doubts as to its practicability in this country. Were the knowledge of the subject confined to mere statements there might be some reason for their doubts, and to remove these from the most sceptical I have told, at the risk of wordiness, in plain language the methods which led to the successful transportation to Sydney of perishable fruits grown in the far away orchards of California—a success of development which the pioneers of artificial cold in their most sanguine moods never dreamt of. Before leaving this portion of the subject I should again say that while a correct temperature and suitable cases are the two important matters in holding over fruit for lengthened periods, both these are utterly valueless unless the fruit be gathered in the proper way, and at a certain stage of its growth. First, whether grapes, apples, pears, or stone fruit, all must before picking have attained full growth, but not ripe, hence it will be seen that fruit for lengthened storage must be specially picked for that purpose. If, say a peach be the subject, and it is allowed to attain a state of ripeness calculated to fetch the best price locally, such would not keep so long in the cool chambers as others less ripe, still very ripe specimens have been kept lengthened periods, but when so the temperature was kept lower than is usually accepted for the standard for such fruit. In other words perfectly developed peaches, and other stone fruit, and tomatoes, but not ripe, will continue in their green state until removed from the store, and when taken to a subdued light will slowly attain the natural ripe

colour of the variety. If put in a strong light, say, a shop window, they will ripen in a few days, but will not keep so long as those ripened less quickly. It need scarcely be said that all fruit intended for storage should be carefully cut, and any specimens with the slightest bruise, prick, or other defect should be rejected. This applies to every variety. A very ripe fruit with the slightest bruise will decompose almost immediately in the cool stores, the moisture spreads into the surrounding cardboard, a growth of mould ensues, and if unnoticed, the contents of the entire case may be lost; such bruise, if in a less ripe specimen, is not of so immediate danger, but in every instance those showing the slightest defect should be discarded; in this way only is safety assured. Fruit intended for storage should be packed in the orchard, and, if possible, in the morning, provided the dew has evaporated, and kept in a cool place until despatched, and to make assurance doubly sure should be carried in cool railway cars, this in our State being a simple matter, ice being plentiful and cheap. In one instance a large shipment of American apples and pears arrived in London very much decayed, attributable to the fact that the grower allowed them to remain in the orchard over Sunday after packing; the weather was warm, and the fruit became heated. When using the approved American cases, each fruit should be large enough to be sufficiently tight in the cubical space to prevent movement in transit, while the cardboard on bottom and top of case ensures the fruit from touching the wood, some sorts of which impart an undesirable flavour to the fruit. Speaking generally, fruits that flourish best in a temperate climate require a colder temperature than tropical sorts. Quite a number of scientists and others interested in the carrying of fruit over long distances and time, have made many experiments with the various sorts. These people are now looked upon as reliable authorities and, although differing slightly, such difference will not affect for ill even the tenderest berries. The following will show the results of the experiments and recommendations of several cold-store authorities and other experts:—

TEMPERATURES ADAPTED FOR THE COLD STORAGE OF VARIOUS FRUITS.

	Wallis-Tayler.	Siebel.	Getty.	Ice and Cold Storage.	Madison Cooper.
Apples	32-36	33	32	33-36	31
Bananas	40-45	34-36	35	40-45	....
Grapes	36-38	32-40	32-40	36-38	34
Lemons	36-40	36-45	35-45	36-40	38
Melons	....	....	....	....	35
Oranges	34-40	32-33	32	35-40	36
Peaches	45-55	35-45	35-45	45-55	36
Pears	34-36	34-36	38	35	33
Plums	....	....	....	....	32
Tomatoes	....	34	38-42	....	....

Although there appears a moderate difference in the above authorities, such may have arisen from the stage at which the various

experimentalists may have gathered the fruit, or the margin may have resulted from the fact that all did not experiment with the same variety of peaches and other fruit, and it is of interest to know that the plums, grapes, and peaches which arrived in Sydney from California, were all carried in the same temperature. Cherries can be held over from two to three months, while strawberries and other berries can be kept in a temperature of from 34 to 40 for two months, which is about the extreme of their keeping time. Other fruits, not enumerated in the above, and those peculiar to Australia, can all be kept for a greater or less time, according to their nature and time of gathering. In concluding this portion of the subject, it should be stated that all the experiments conducted at the Department's cold stores were in temperatures considerably colder than those mentioned in the tabulated list, this, however, not from choice but of necessity, as other goods demanded the lower temperature.

The Cold Storage of Vegetables.

It has been mentioned in a previous issue that the city freezing companies evidently harbour the idea that cold storage possibilities begin with sheep for freezers, butter, fish, game, poultry, and a few miscellaneous items following, and this, despite the fact that scores of tons of valuable goods—fruit—go annually to waste in the city, while the chill-rooms for a considerable time have been partially empty; in other words, these tons of wealth were going to loss in the city, and, perhaps, a few hundred yards away, the great preservative was also going to waste, all through the absence of some initiative to bring them together. With this indifference in relation to fruit, it could scarcely be expected that such common things as vegetables could be considered within the region of profitable storage, still they are and to a much greater extent than many kinds of fruit. The first practical illustration at the Government stores was in 1899, when a city wholesale vegetable merchant, through big consignments of green peas arriving from Melbourne and Tasmania on the same day, found a general slump in prices, the 2s. a bushel on a Tuesday having dropped to about 6d. on the following day, consequent on the importations. Application was made as to whether they could be held over for a few days in the cold-room with any degree of safety, and on an assurance in the affirmative, several loads were carted in and held for some three weeks and then placed on a comparatively bare market, the owner profiting by the transaction to the extent of some £4 after paying the cost of storage and cartage. Several like transactions took place until the Department's space was sufficient only for export goods. However, these and other cases clearly demonstrated the fact that vegetables of many sorts can be profitably stored, thus preventing a glut, the market benefiting generally by the removal of the surplus stocks.

The Department, discontinuing this storing business after demonstrating its practicability and commercial soundness, left a splendid

opening for private firms to establish a good business in the storing of these and similar commodities, but whether or not such business is catered for by any of them I am unable to ascertain. The possibilities in vegetables of the various sorts are immense. Take, for instance, onions; these can be kept for a lengthened period in ordinary dry rooms, but, on the approach of spring, they commence to sprout, when there is rapid decay. In the plentiful time such can be purchased for from £3 to £4 a ton, while in the off season sound specimens frequently run up to three times that amount. Celery is unobtainable at some seasons of the year, and, if kept over to such time, would return a handsome profit to the owner. Rhubarb ditto; but take that vegetable aristocrat of the dinner table—asparagus. For a month or two this can be had for 1s. the small bundle, and the parties who store this can realise five times that amount during the time that it is not otherwise available.

Many other vegetables can be profitably kept in the cool rooms; the possibilities of even the common garden cabbage are worth exploiting. Prior to time of writing, a visit was paid to the wholesale vegetable market, when it was found cabbages of a moderate size were selling slowly at from 6d. to 1s. a dozen, and, just as sure as we get our usual January and February temperatures, so surely will they rise in price four-fold. However, there is no need to enumerate all the articles to which cold storage can be applied, but, unfortunately, to a most limited extent has it been utilised in this country. At the same time there is evidence that the future will witness big developments, a distinct departure having taken place a few days ago, when many hundred bags of Argentine maize were placed for a few days in Messrs. Birt & Co.'s freezing stores, the object being to kill the weevils. The presence of these, it is said, contributed to a big loss on the importation which otherwise would have resulted in gain. Dried fruits of various sorts are stored for the same purpose, to prevent or kill the weevils; nuts of many sorts are subject to the same process for a like object, while some of the American cold rooms are used solely in the summer months for storing ladies' furs and fur-trimmed clothing, to preserve them from moths, &c. The great dry-goods house of Messrs. Marshall, Field & Co., in Chicago, have a single room, or vault, containing over 60,000 cubic feet of space filled with a net-work of piping, narrow stairs and gangways, to reach the various tiers of pipes on which the garments are suspended; it is stated that, when filled, this vault contains over $2,000,000 worth of stored fur garments. The Canadians are also alive to the fact that fruits can be kept to prevent loss, the Government of that country at every favourable opportunity giving demonstrations to growers and others on the subject, particularly at the time of the Toronto Exhibition, when the Chief Inspector of the fruit division of the Agricultural Department gave demonstrations each day, showing the correct methods of packing apples, pears, &c., for export. A Canadian paper, referring to the above, remarks: "Every year is heard more or less complaint as to the condition in which Canadian fruit reaches the foreign markets, and the reputation of Canada is impaired on account of the folly of some who either

wilfully forward inferior stuff or are culpably negligent in packing it properly. The dearth of fruit in Britain this year affords a great opportunity for Canadian fruit men to make themselves solid with the British market. The Briton is slow to take anything up, but he is all the better customer once a connection is formed. He will be forced this year to take our fruit, and if it is properly packed and marketed, its superior qualities will do the rest." And what the Dominion Government are doing in the interests of the producers will be seen from the following extract, taken from *Cold Storage and Ice Trade Review*:—

The cold storage system devised and directed by the Dominion Department of Agriculture has done much to expand Canadian commerce in food products. It has taken into account the various interests of the producers, the collecting buyers, the carriers or transportation companies, the distributing merchants, and the consumers. By preventing losses by deterioration in quality, it has increased the profits of the dealers and augmented the wealth of the country. The Dominion Government led the way to all this; cold storage in every phase has been tried and found effective; but as at first the volume of trade might not have been sufficient to induce business men to put up cold storage warehouses for the accommodation of products intended for export, a grant was offered to those who would provide cold storage buildings at central points, such grant being in the nature of a guarantee that the earnings from the cold storage business at these points would yield at least 5 per cent. on the cost of buildings and plant. Obviously, the rates to be charged were to be satisfactory to the Department of Agriculture, and the grants from the Government were not to be called upon except to make up any deficiency between the net earnings and the sum of 5 per cent. on the cost as mentioned. Advantage was taken of this offer at Quebec only. That capital put into cold storage warehouses will prove a sound remunerative financial investment is not now open to doubt, for this system has passed far beyond the experimental stage, and without the realm of possible failure. In Great Britain private enterprise has not been wanting in providing cold storage warehouses for at least the last ten years, and substantial dividends have been declared upon marketing results. In Canada, with the greater need and the lesser marketing cost, such warehouses ought to form an attractive source for capital investment.

The following list will show the varied nature of goods, in addition to fruit and meat commercially treated with the cold process in America, and if necessary in that country, how much more so in this:—Ale, asparagus, beans, peas, beer (both in casks and bottles), flour, cabbage, carrots, celery, cheese, chestnuts, cider, cigars, clarets, maize, maize-meal, cranberries, cucumbers, dates, figs, hams, hops, honey, lard, nuts, oatmeal, onions, oysters (in shells and in tubs), parsnips, porter, potatoes, sardines, sausages, tobacco, wheat-flour, wines, woollens, &c., &c.

Cold Stores and Markets.

The majority of writers on agricultural matters anxious to make a good case for the subject dealt with, whether it be stock or crops, invariably point to the mismanagement and shortcomings of those engaged in the particular industries, and perhaps of all the rural community those engaged in fruit-growing suffer most from critics. Apathetic is the adjective usually employed to describe the grower's alleged indifference to modern methods, his lax manner of marketing, and his unconcern for markets abroad. Concerning this indifference, I maintain that, however valuable, it is no part of the orchardist's work to exploit in what so far has proved hazardous speculations. Local markets and market-places are customarily provided by the municipal or other civic authorities. It is here buyer meets seller, and should the demand for the article for sale be such as to readily absorb the quantities offered, normal prices obtain; on the other hand, should the population be insufficient to consume all that is offered, or an abnormal crop be in evidence, prices naturally fall, this prompting the inquiry about outside markets. But it has to be recollected that no matter how desirable or essential foreign markets may be to any industry, it rarely happens that the grower or raiser of the article is the party who directly ships to such markets. It is the wheat-grower's business to prepare the ground, sow, reap, and sell his grain to the best advantage; and the stock-breeder's to raise the cattle most suited for the local or other markets; but these people rarely export. The majority of them have no time to go into the intricacies of freight, wharfages, insurances, landing charges, commissions, &c., nor do they consider it their business. They sell their wheat to the merchant, who, if profitable, disposes of it locally; otherwise he exports it to England or elsewhere. The stock-owner does the same thing. In like manner it is the orchardist's business to grow the best fruit he can and put it into money in the shortest possible time, and even were the safe carriage of his fruit to other countries guaranteed, the grower has no inclination to trouble about how many cases of 17 x 13¼ x 9½ cubic measurement go to the ton, while f.o.b.'s and c.i.f.'s are to him but hieroglyphics. However, there is one great difference between the wheat and the fruit-grower; the former, if over-produced for local requirements, has always keen competition for its purchase to send to other countries, and herein lies the orchardist's handicap. In his season of plentifulness there is neither merchant, capitalist, nor other speculator to buy up the surplus fruits for shipment, this arising not from want of markets abroad, but rather from the belief that the nature of the goods prohibits their safe carrying. This, then, is the position at present; but surely now that safe holding over and carrying has been clearly demonstrated, there will, in the interest of the fruit business, be some scheme evolved, either in the way of a syndicate, company, or other moneyed individual to purchase largely for storage purposes, and when this be a proved success the exporting will assuredly follow. But right here the initial difficulty presents itself.

Where is the cold store that is suitable for such purpose? The City Council, for a much less important industry—fish—provide at Woolloomooloo cool chambers, but this is the extent of municipal trade in temperatures. The Belmore Markets have excellent floor-space, but otherwise the construction of the place is in no way adaptable for insulation, except at great cost. There are, of course, the various city freezing stores already referred to, but even were these available, the cost and risk of transport from and to the fruit markets would, it is feared, be more than the business would afford. The chief consideration in the designing of such stores should be the question of easy transport from the railways and wharves, together with their close proximity to the fruit markets, and to further obviate expensive handling the cool rooms should be on a level with the market floors. That there is no such place in Sydney goes without saying; hence, suggesting to fruit merchants to cold store their fruit is tantamount to telling a hungry Sydney man that there is beef at Bourke. The difficulty, however, is not insuperable—there is more than one way out of the wood.

We have all read of, heard of, or seen, the present new wholesale fruit market in course of construction at the foot of Bathurst-street, which is a notable exception in ownership to the usual municipal proprietary of such. This handsome two-storey structure is being erected for a fruit co-operative company, and is calculated to cost £10,000, has a splendid floor-space, and frontages to Barker, Duncan, and Steam-mill streets, and there is a fine row of some dozen shops or stores facing the latter, and extending from one end of the building to the other, with an entrance both to street and floor of markets. I have no idea whether the fruit company, when authorising plans for its construction, contemplated at a later date to include the storing of fruit as a business in their operations, but, whether or not, from a late personal visit to the place, there is not a doubt but that these shops lend themselves most excellently to insulation, and whether the company will in the near future convert two or three of these proposed shops into cool rooms, or allow the cold stores for fruit to be relegated to a special proprietary, it remains a fact that the place mentioned is most adaptable for conversion. What the cost of a plant and insulation of two or three of the above shops would be is a subject for the refrigerating engineers, and one thing is certain, if run on the following lines it would pay from the start. Should the matter be entertained by the company I would make the following suggestions, which are applicable to the storing of fruit, the exporting business, as previously mentioned, being one of the developments. First, the directorate should contract for a plant of sufficient size or power to cool, say, half-a-dozen of the stores in question, but there is no occasion for a year or two to insulate more than two or three of these. One could be divided into, say, a dozen lockers or cubicles with wire frame-work divisions, such as is used for shop windows, &c. These lockers could be let to the wholesale fruit merchants who do business in the markets at, say, from 15s. to 30s. per week, according to the number of cubic feet, each tenant to be

supplied with a key of his rented section, but having access only through the main door, and subject to the officer in charge of the rooms. Some of the advantages to the fruit merchants would be as follows, but others would occur. There are various kinds of fruits such as merchants require for some customers that deteriorate in a day or two, and when the morning's sales are nearly over, to make a clearance these have to be got rid of at what is known as giving-away prices. Such would be prevented had he the cold store to fall back upon. Very ripe goods may arrive on a particular morning. The merchant at present has to venture sparingly on these, fearing to overdo his day's demand, but with his cold locker on hand, there is no need to limit his purchase, and those that are unsold can be safely held for a day or days. Again, when the market for any particular sort was over supplied, and prices low, two or three week's rent of his cool space may be saved on a morning's purchase. Further, when the season is at its best for certain varieties, say peaches, the wholesale man with a chill room can purchase largely, and be in a position to supply his customers with the choicest sorts for many weeks after the legitimate season, when his fellow dealer not provided with like storage would be at the mercy of the season. Many other advantages would occur when the place was in active operation, all of which would tend to swell the wholesale dealer's profits, and enable the fruit-buying community to purchase home grown fruits at all seasons, rather than be dependent on those of Californian origin. The room I have described above, divided into cubical spaces, and sublet to merchants, I will call chamber A; the next one, B, could be used for storing for the general public, retailers, growers, dealers, and others who do not rent space in chamber A. The goods from these would be taken in at all reasonable hours of the day, at a certain charge per case, such charge to cover, say, three days' or a week's storage, but the same charge to be made should the goods only be kept for an hour. Room C could be used as a bulk store for vegetables of various sorts, and in big quantities, the charges here to be on a lower basis, and to cover a longer time. Room D could be divided into, say, four sections, and shelved; different temperatures could be had in these four sections. Strawberries and other tender fruits could be kept here, the charges to be on a higher scale. All charges would, of course, have to be based on a scale sufficient to pay the company, the profits resulting from the storing well enabling the customers to pay a fair charge.

The above is one way out of the difficulty of lack of cool stores; the other and more daring one, but safe withal, would be the formation of a fruit storage and exporting company, and with the vast possibilities of the business, there should be no difficulty in securing sufficient capital, seeing that scarcely a week passes but companies are formed in connection with schemes with a minimum chance of ever paying a dividend. If such a company were formed, and a directorate of commercial people at the helm, there should be no question as to its success; indeed, if the business was properly exploited, it should pay from the start, assuredly not so well as the notable South African Cold Store Company, which took over a not very large butchering

business in 1899, and in 1901 showed the huge profit for the year of £1,109,591, paid £105 per cent. to the shareholders, and carried forward £737,000. It was transformed into another company, with an Australian element and title, and is said to be now making considerable losses. So far as a Sydney company is concerned, the first extreme would not be anticipated, and with average management the latter would be averted. It is not my purport to suggest the amount of capital required, or even advocate such a scheme, the desire being to show that as there are no city stores available, the difficulty should be but a temporary one. The cost of a refrigerating plant depends on the length, height, width, and the number of the stores, and the temperature to which they have to be cooled, for it will be evident that to refrigerate 50,000 cubic feet to zero would be a much more expensive matter than the bringing of the same space down to 30 degrees, and in any proposed scheme a lower temperature than 30 would not be required; and speaking generally, any figures between 34 and 40 will do most sorts, the tables previously given being those calculated to give the best results, but a few degrees higher or lower will not affect for ill any variety of fruit, provided there be a minimum of 33, below which most sorts will freeze, and, although this will not affect their keeping time in the room, immediately they are removed from the stores they decompose, and just here it may be said that should a company eventuate whose object is the cold storage of fruit, &c., the first provision they make should be a determination to do neither freezing or ice making, and in this way there will be no friction with existing freezing institutions, but perhaps win their support and patronage. What the prospects would be from a promoter's point of view, would depend on the amount of capital invested, the business done, the charges made and management, but for those who would use the stores the profits are at once apparent. The current quotations for choice oranges at the present time are from 14s. to 18s. per case, in the plentiful season from 4s. to 6s. is the usual rate; half-a-crown a case would handsomely pay the storage of the above for from four to six months, which, with other allowances, leaves a big profit. Cherries are now sold as low as 2s. the box of 12 lbs.; in a few months these would be good property at three times that figure. Indeed at the date of writing this variety of fruit is being hawked through the streets at three pounds for sixpence. These must have been purchased for half that amount to afford a day's wages to the two retailers, what the grower gets after paying freight and commission, &c., would amount to perhaps less than one halfpenny per pound, but then nearly every variety of fruit will for some time to come be sacrificed, but in all cases freights and commissions have to be paid, the remaining moiety being the growers. Coming to the Californian fruits, the wholesale prices were for several months 18s. for the case of punnets containing 24 lb. of grapes, or about 9d. per lb., as equally good quality of our own have in the past, and will during the present season be disposed of in bulk lots at a penny, choice muscatels frequently changing hands at 2d. and 2½d. per lb. Local storing of our own will effectually stop the Californian article, for the simple

reason that after paying storage rates there will be a good profit left to all parties, and the goods retailed at sixpence a pound, as against a shilling for the Americans.

The following quotation from the Sydney daily papers of October 22 is the most convincing evidence of my contention right through this and the preceding article:—

Pears.—American: Howells, 6s. 6d.; Winter Nelis, 7s.; B. Hardy, 5s. to 6s.; Buerre Clairgeau, 7s.; Keifer, 7s. Duchesse, 7s. to 8s.; Easter Buerre, 6s. 6d. to 7s. per case.

Plums.—American Golden Drops, 5s. to 5s. 6d. per box of 9 dozen.

Peaches.—American Salway Slipstones, 8s. to 8s. 6d. per box of 48, 50, and 70.

Grapes.—American, 18s. per box containing about 24 lb.

Apples.—American: Red Pearmains, 12s. 6d.; Newtown Pippins, 11s. 6d.; Jonathans, 13s. per bushel-case.

It has to be remembered too that, except in apples, the fruit case in the above quotation is the small one mentioned in the previous article, perhaps not a third the size of the well-known gin, and considerably less than a cubic foot measurement; however, the quantity they hold is the best test of value. The largest peaches were about the size of our medium ones, and fetched wholesale 8s. for 48, or 2s. per dozen, this being four times the value of our own when in season. However, there is no need to follow the thing further, except to say that the storing of fruit is no new thing. The only claim made in this article being the not unimportant one of showing in a detailed and plain way its practicability, and to prove, as the "Herald" some time ago said, that the solution of the fruit problem does not lie in some yet undiscovered process, but by improving the means now at hand.

Inducing Young Apple-trees to Bear.

In reply to the inquiries of a correspondent as to the steps to be taken to induce apple-trees 4 years of age to bear, the Fruit Expert, Mr. W. J. Allen, states:—Some varieties of apples will bear a small crop in their fourth year, but others do not produce much fruit until two or three years later. It is best not to encourage the too early fruiting of fruit-trees. The main thing is to ensure steady growth of the tree during the first few years of its life, so that as time goes on it may become a well-grown tree, capable of carrying large crops regularly. To encourage the production of good fruiting wood, it is well to go over the young tree and cut back to a length of about 4 inches all young growth found in the heart or centre of the tree, leaving (say) three or four buds in each; also any strong growth which may be found crowded or growing too much towards the centre of the tree may be removed or cut back, leaving three or four buds at the base, and the extreme ends of all growth may be cut back 6 inches at first, and again towards the end of summer. At the late pruning, even more thinning-out can be done.

Manures for Passion Vines.

SECOND REPORT ON A SERIES OF EXPERIMENTS CONDUCTED AT GLENORIE.

IN submitting the report, Mr. W. J. Allen, Fruit Expert, states:—"At the conclusion of the spraying and fumigating experiments which I carried out at Glenorie some two and a half years back, the Fruit-growers' Progress Association wrote to the Minister for Agriculture, requesting that I might be permitted to carry on a series of experiments with different manures to be applied to the passion vines, which at that time were apparently suffering from some disease, and in the case of many growers the crops were practically nil, while with others that produced was unmarketable. This state of affairs obtained throughout the whole Cumberland district, the vines suffering most being the older ones. Having obtained your approval, and at my suggestion, Mr. Guthrie made up a list of manures which he considered should be tried, and on the 1st of November, 1901, I visited Glenorie in order to apply the different manures, which I weighed out in ounces and pounds according to the several formulæ used, and saw that they were properly applied to each vine in those portions of the vineyards set apart for treatment.

"Mr. Guthrie prepared manures according to forty formulæ, details of which were published in the *Agricultural Gazette* for March, 1903, and during the first season there were nine vines treated with each of the different mixtures in four different vineyards, viz., those of Messrs. King, Dale, Taylor, and Arnold, the soil differing in each. While it was found impracticable to pick the fruit from each vine and keep it separate so as to ascertain definitely which manure gave the heaviest yield in pounds, yet by careful attention and frequent inspections of the vineyards in company with the abovenamed gentlemen, we concluded that the mixtures numbered respectively 20, 21, 22, 24, and 26 gave the best results.

"After a further consultation with Mr. Guthrie, we concluded to manure three plots of vines, each plot consisting of 60 vines, in the vineyards of Messrs. King, Dale, and Taylor, with the following mixtures:—Mr. King's with Nos. 21, 22, and 24; Mr. Dale's with Nos. 20, 21, and 26; and Mr. Taylor had four plots manured with Nos. 20, 21, 22, and 24. Also, nine vines each were again treated with the forty mixtures the same as in the previous year; and after going carefully through all the vines at the end of the second season we could not find that any of the other mixtures were showing any better results than the numbers tested on a large scale, *i.e.*, 20, 21, 22, 24, and 26; but the vines which showed little or no benefit were those treated with mixtures Nos. 2 to 10, inclusive. In most cases the application was so small as to be useless, and in no case did they

give satisfactory results, in fact, the vines were so weak at the end of the second year that they were of little value, and Mr. Taylor's loss through not having these vines properly manured will be considerable, but he is satisfied that the information gained by this series of experiments will pay him a hundredfold for any loss which he may sustain.

"During the two years covered by the experiments, I paid eight visits of inspection, in two of which I was accompanied by Mr. Guthrie.

"In conclusion, I would like to say that I am sure that on most of our soils where passion-vines will grow well that it will pay handsomely to manure liberally, as the vines crop better, carry a better quality of fruit, and will last longer than unmanured vines. The unmanured vines could at all times be picked out from those manured at a distance of a quarter of a mile, as they were yellow in colour, did not put on anything like the growth of the manured, and, as can be seen by the report of the Glenorie Fruitgrowers' Progress Association, they were anything but profitable.

"Considerable interest was taken in these experiments, and I feel sure the results have proved highly satisfactory to those who have been following them up. I have to thank the members of the Association for their hearty co-operation, and especially Messrs. King, Taylor, and Dale, who have rendered me every assistance during the two years of these experiments, and have taken careful notes of the results of the different manures on the different soils."

DETAILED REPORT of Committee appointed by the Glenorie Fruitgrowers' Progress Association to co-operate with Messrs. Allen and Guthrie in the supervision and carrying out of the manure tests:—

Messrs. Allen and Guthrie visited the orchards of Messrs. King, Dale, and Taylor on November 7, 1902, where experiments are being carried out with the various manures, mixed on the basis that the passion vine removes from the soil 6¼ oz. nitrogen, 1½ oz. phosphoric acid, and 4 oz. potash. The complete manures, Nos. 20, 21, 22, 24, and 26, proved so far to have given the best results, and it was then determined to have a block of land set aside in each orchard, using only the five complete manures, which are as follows:—

No. 20.—32	oz. sulphate of ammonia.	No. 24.—16	oz. sulphate of ammonia.
9	,, superphosphate.	26	,, dried blood.
6½	,, potassium chloride.	9	,, superphosphate.
No. 21.—52	,, dried blood.	8	,, sulphate of potash.
9	,, superphosphate.	No. 26.—21	,, nitrate of soda.
6½	,, potassium chloride.	26	,, dried blood.
No. 22.—43	,, nitrate of soda.	9	,, superphosphate.
9	,, superphosphate.	8	,, sulphate of potash.
6½	,, potassium chloride.		

Mr. Allen came to Glenorie on November 24th, 1902, to sow the manures, each grower interested helping the other, so that the distributing was done in a most expeditious manner, each vine

receiving the exact quantity named in the formula. The manures were then harrowed in, the next day being ploughed, and harrowed again after the first rainfall. The land was worked in the usual manner, chipping, harrowing; and ploughing when required. The results from Mr. King's orchard were as follow:—

60 old vines manured with No. 21 gave a crop of 38 boxes of prime fruit.
60 ,, ,, No. 22 produced 36 boxes of fruit.
60 ,, ,, No. 24 produced 31 boxes of good fruit.

The results from Mr. Dale's orchard were as follows:—

	£	s.	d.
60 young passion vines manured with No. 21, 30 gin cases were marketed for	10	6	8
60 ,, ,, No. 20 produced 28 cases, market value...	9	15	6
60 ,, ,, No. 26 produced 32 gin cases, market value	10	18	9
Total value	31	0	11

The report from Mr. Taylor's orchard was as follows:—After the manures were sown and ploughed in, the quickest manure to act was No. 20, but being too active drove the vines to wood, the fruit being too early to gain top prices in the market, light foliage, fruit fair average quality. Should recommend this mixture to growers who are late in putting in their manures. No. 21 was not so forcing as the previous mixture, until plenteous rainfall, when the difference was particularly noticeable between the rows; the vines then commenced a most vigorous growth. Should not recommend blood manures for summer manuring, winter only. No. 22 most suitable summer mixture, moderate action, vigorous growth, fine fruit in size, nice flavour, luxurious foliage. No. 24, best quantity of sulphate of ammonia to use, vigorous growth, fine foliage, dark colour, best quality fruit, and abundant, which came unfortunately rather early, therefore did not command the highest market value. Strongly recommend sulphate of potash for quality of fruit and color. The vines began to fruit early in the year, picking commenced the first week in January, and the following accounts show the results:—

Summer Crop, January and February, 1903.		£	s.	d.
No. 20.—60 young Passion Vines, picked $3\frac{3}{4}$ cases prime fruit at ...	5/-	0	18	9
No. 21.—60 young Vines.. ... ,, $4\frac{1}{4}$, average price per case ...	5/-	1	1	3
No. 22.—60 young Passion Vines, ,, 3, ,, ,, ...	5/-	0	15	0
No. 24.—60 ,, ,, 4, ,, ,, ...	5/-	1	0	0
		£3	15	0
March (commencing the Easter Crop).				
No. 20.—60 young Vines, picked $1\frac{1}{8}$ cases at	10/-	0	11	3
No. 21.—60 ,, ,, $1\frac{1}{8}$,, ...	10/-	0	11	3
No. 22.—60 ,, ,, $1\frac{1}{2}$,, ...	10/-	0	15	0
No. 24.—60 ,, ,, $1\frac{1}{4}$,, ...	10/-	0	12	6
		£2	10	0
April, Easter Crop (continued).				
No. 20.—60 Vines, picked $3\frac{1}{8}$ cases at	12/-	1	17	6
No. 21.—60 ,, ,, $3\frac{1}{4}$,, ...	12/-	1	19	0
No. 22.—60 ,, ,, $4\frac{1}{4}$,, ...	12/-	2	11	0
No. 24.—60 ,, ,, $3\frac{1}{2}$,, ...	12/-	2	2	2
		£8	9	6

May.

		£	s.	d.
No. 20.—60 Passion Vines, picked 2¼ gin cases at	12/-	1	7	0
No. 21.—60 ,, ,, 3¼ ,, ...	12/-	1	19	0
No. 22.—60 ,, ,, 2¾ ,, ...	12/-	1	13	0
No. 24.—60 ,, ,, 2½ ,, ...	12/-	1	10	0
Total 10¾		£6	9	0

June, Winter Crop (commenced).

No. 20.—60 Passion Vines, picked 2⅛ cases at	10/-	1	1	3
No. 21.—60 ,, ,, 2½ ,, ...	10/-	1	5	0
No. 22.—60 ,, ,, 2¼ ,, ...	10/-	1	2	6
No. 24.—60 ,, ,, 2¾ ,, ...	10/-	1	7	6
Total 9⅝		£4	16	3

July, Winter Crop (continued).

No. 20.—60 Vines, picked 3½ cases at	10/-	1	15	0
No. 21.—60 ,, ,, 3¾ ,, ...	10/-	1	17	6
No. 22.—60 ,, ,, 3½ ,, ...	10/-	1	15	0
No. 24.—60 ,, ,, 4 ,, ...	10/-	2	0	0
Total 14¾		£7	7	6

August.

No. 20.—60 Vines produced 7½ cases at	7/6	2	17	3
No. 21.—60 ,, 8 ,, ...	7/6	3	0	0
No. 22.—60 ,, 10½ ,, ...	7/6	3	18	9
No. 24.—60 , 7¾ ,, ...	7/6	2	18	11½
Total 33¾		£12	14	1½

September.

No. 20.—60 young Vines, picked 6½ cases at	11/-	3	11	6
No. 21.—60 ,, ,, 4¾ ,, ...	11/-	2	12	3
No. 22.—60 ,, ,, 6¾ ,, ...	11/-	3	14	3
No. 24.—60 ,, ,, 4¾ ,, ...	11/-	2	12	3
Total 22¾		£12	10	3

October.

No. 20.—60 Vines, picked 1½ cases at	14/-	1	1	0
No. 21.—60 ,, ,, 1¼ ,, ...	14/-	0	17	6
No. 22.—60 ,, ,, 2¼ ,, ...	14/-	1	11	6
No. 24.—60 ,, ,, 1¾ ,, ...	14/-	1	4	6
Total 6¾		£4	14	6

Working Expenses.

The vines were picked 44 times, at the average cost of 3s.	6	12	0
The fruit was picked up off the ground 20 times, at a cost of 9d. each time ...	0	15	0
Cost of manure, 240 vines, at the average cost of 5d. per vine	5	0	0
Carting 132½ cases to railway, at 6d. per gin case	3	6	3
Railway carriage, at 1d. per case	0	11	1
Cartage to the markets from rail, 1d. per case	0	11	1
Commission of sales, at 6d.	3	6	3
Chipping	3	0	0
Ploughing	1	10	0
Cultivating 8 times in the year	2	0	0
Tying, clipping, and general attention	2	10	0
Cost of cases lost	2	8	0
Total	£31	9	8

Total production of 240 Vines, manured, as follows :—	£	s.	d.
No. 20.—60 Vines	15	0	6
No. 21.—60 ,, ...	15	2	9
No. 22.—60 ,, ...	17	16	0
No. 24.—60 ,, ...	15	6	10½
Total	£63	6	1½
Working expenses	31	9	8
Profit	£31	16	5½

Only the primest fruits were marketed, and the whole of the consignments were sent to the Farmers' and Settlers' Co-operative Society.

When taking into considering the quantity that fell and were wasted in the summer time, there is not the slightest doubt that the yield was fully one gin case from a vine, but as a matter of fact 132½ gin cases of prime fruit were marketed, averaging about 500 fruits in a case, gives us, in round numbers,

132½
500

66,250

passion fruits from one acre of land. As this is a most exhaustive crop to grow, it is folly to expect a succession of crops without manure, which the following account will prove. Seventy-seven young passions were left unmanured after they had attained one year's growth ; they were worked and looked after the same as the manured vines, but after paying working expenses left a profit of only 12s. 6d., or about 2d. per vine. Now, by spending 5d. per vine in manure, and that vine properly attended to when it is in its prime, will show a profit of 2s. 6d. per vine per annum for three years, before and after which it is on the upward or downward incline. The passion vine remains profitable for five years in this district, and it is utter folly to neglect manuring, as that is the principal medium of profit, and no grower can afford to grow passion fruit in the Glenorie district of New South Wales for profit without manuring.

(Signed) JOHN TAYLOR,

Dec. 7th, 1903. Longsdone House, Glenorie, N.S.W.

JAPANESE SUPERPHOSPHATE.

SAMPLES of superphosphate imported from Japan have been submitted to the Department for analysis.

The control of this fertiliser is in the hands of Messrs. A. H. Hasell, 2 Bridge-street, Sydney, who guarantee that the standard represented by the analysis will be maintained.

The analyses are as follows :—

	Slate-coloured.	Buff-coloured.
Insoluble matter	0·56	6·50
Total phosphoric acid	20·15	21·87
Equivalent to tri-calcic phosphate	43·99	47·74
Water-soluble phosphoric acid	18·87	15·13
Equivalent to tri-calcic phosphate	41·24	33·03

Dairy Shorthorn Herd-book.

At the invitation of the Hon. John Kidd, Minister for Agriculture, a Conference of Cattle-breeders was held during December, in Sydney, to discuss the question of establishing a Herd-book for Milking Shorthorn Cattle.

In opening the meeting, the Hon. the Minister said:

On the 10th November a circular was sent to the various Agricultural Societies throughout the dairy districts of the State asking them to appoint a delegate to this conference. Notwithstanding the fact that these delegates are paying their own expenses a good many have been appointed, and this in itself shows the great interest that is being taken in this movement. Representatives are here from the far north of the State, namely, the Richmond River, at considerable expense, and it is hoped that this meeting will be productive of good results, and that the object in view will be attained.

As the delegates are aware, the initial meetings have been held at Kiama, Lismore, and Grafton, at which meetings representatives were present from the various district societies. These meetings were attended by Mr. Campbell and Mr. O'Callaghan, and the details of the proposed scheme in reference to the herd-book were fully explained by Mr. O'Callaghan; and I understand all present expressed themselves in favour of the scheme being carried to a success. For this reason this Conference has been called.

We are told that there are no pure bred shorthorns of a milking strain in the State. This is scarcely true, because, apart from any others, there are the milking shorthorns which were recently imported by the Department of Agriculture. There are also their progeny. Apart from these, however, there are throughout the State a number of cattle that are inferior to none as milkers, and that show, without doubt, the main shorthorn characteristics. It is to preserve these specimens and to hold out an inducement to have them mated with bulls of a similar type that the establishment of a herd-book is suggested. Wherever it has been deemed necessary to stimulate any particular type of animal, it has been found that the greatest stimulus which can be given in this direction is by the formation of a herd-book on a sound basis, in which will be registered all the animals of the type desired available at the time. This forms the basis, and immediately the farmer, whether large or small, finds that he has an animal sufficiently good to obtain registration in the herd-book, he is given a desire to mate that animal with a bull which will produce a calf eligible for entry in the herd-book, thereby increasing the number of that type, and by so doing furthering the interests of the dairying industry.

The educative effect of such a book and such a movement is very considerable. It touches all farmers, because if they find their neighbours have cattle good enough for entry it stimulates them to go and do likewise. Thus the number of young bulls available of a character calculated to improve our dairy stock will be increased, and the number of people breeding improved cattle will also be materially increased.

I understand that some breeders, seeing the necessity for some such movement, contemplated the formation of a Society at last Sydney Show with this as one of its objects, but no Society was formed until lately. The Department took the matter up and convened the meetings as stated. Then some breeders met, and formed a Milking Shorthorn Society. This Society, however, does not represent the entire State, and from what I can gather the members of the Society in question are only too glad to get others on the Council and in the society from districts representing the entire State. This, I hope, will be part of the result of to-day's meeting.

The breeders who have already taken action with regard to forming a Society are to be commended in their effort, but it will be evident to all that the value of that Society will be greatly increased if the people from the Northern Rivers, namely, the Richmond and Clarence, are included on it as well as those breeders on the South Coast. The Agricultural Societies on the Northern Rivers have expressed themselves as deeply interested in the movement, and I have no doubt considerable support towards the herd-book will be forthcoming from those districts.

I would like to point out that it is the intention to admit animals to this book which are of a shorthorn character only, and not alone will it suffice for them to be of a shorthorn type and character, but they shall also have to show evidence to the selection judges of milking qualities. Animals showing crosses of Ayrshires or Jerseys or other breeds will not be passed by the selection judges; and while on this question I would like to say that the most important work, perhaps, which you will have to do to-day will be the selection of the judges to whom you will grant the power to admit animals to the herd-book. It might be wise to have the number of these judges a small one, so that there shall be less difficulty in having but one type of animal registered in the herd-book.

With regard to the herd-book itself, I have arranged that, if necessary, the *Agricultural Gazette*, which, as you know, has a very wide circulation, both in Australia and abroad, may be utilised for the purposes of the first register or book. This will save any question as regards initial expense which might deter some from joining in the movement, because I understand that the Society recently formed with the object of publishing an annual herd-book of Jerseys has had difficulty in carrying on owing to want of sufficient support to provide the moneys necessary for the publication of these books annually. However, whereas the Society in question represents breeders throughout Australia, this herd-book is to represent New South Wales breeders only. It will be a valuable advertisement for the shorthorn milking

cattle of New South Wales, and it should create a demand for our stock hitherto unexperienced; and, owing to the constitution of the book and the Society, it, of course, will also create a desire on behalf of the breeders to breed these cattle true to type, instead of crossing them with Ayrshires and Jerseys, as has been done in the past to the detriment of the type in many hands. No doubt crosses, especially the first crosses, are very valuable, but they lack type, and if we are to do any good with regard to advertising any particular stamp of cattle we must preserve the type at all costs.

It was decided, on the motion of Mr. H. P. Morton, seconded by Mr. Bartlett, "That those present decide to join with the Milking Shorthorn Association, provided that it is made representative of the whole State."

The following resolutions were carried:—

"That the annual subscription for members of the Association be two guineas a year."

"That the fee for members to enter cattle be 2s. 6d. per head."

"That, in the opinion of this meeting, the entry for cattle for non-members be 10s. per head."

It was resolved, on the motion of Mr. Marr, "That the thanks of this meeting be tendered to the Department of Agriculture, and especially to Mr. M. A. O'Callaghan, for the work done in connection with the Society."

Grapes grown in Infected Districts in Europe are allowed to be Marketed Anywhere.

During his recent vistit to Europe, the Viticultural Expert to the Department, made special inquiries as to the regulations in force in France, Italy, Switzerland and other European vine-growing countries as to the traffic in grapes from phylloxera-infected districts. Everywhere Prof. Blunno received the same answer, that section 2 of the Berne International Convention remains unchanged, and that ripe grapes from vines growing in phylloxera-infected districts may be marketed anywhere without restriction. In the face of this fact, the Hon. the Minister of Agriculture has addressed the Hon. the Minister for Agriculture in New Zealand with the hope that the authorities of that Colony may see their way to remove the existing prohibition against the importation of New South Wales grapes into New Zealand ports.

Sheep Dogs.

ROBERT KALESKI,

Mosman.

As, all predictions to the contrary, the practice of sheep raising, as heretofore, is, and will probably continue to be, the most important industry in this State, it follows that no person following it can afford to neglect any of the details which make for success, and one of them, which is often overlooked by sheep-owners and drovers, is the class of dogs used to handle the sheep. It is too often the case that instead of using one or two well-bred, good-working dogs, the drover or owner has about half-a-dozen nondescripts, which are a nuisance to themselves and everything else in their vicinity, and cause more language and wasted energy than a camel in a horse-yard. It costs no more to feed and look after a good dog than a mongrel, and the dog is then a credit to the owner instead of a disgrace, and if a bitch, and suitably mated, will often prove a little goldmine to its possessor. Of course, sheep dogs work well in all shapes, but why should a man waste time and trouble breaking-in a mongrel, which may or may not turn out good, when, with a good well-bred pup, he can be sure of getting a good worker in a quarter the time. I wish it to be clearly understood that I am in this paper simply giving the results of my own experience and observation, and that I do not wish to say dogmatically that my ideas are right and every one else who dissents is wrong.

The Requirements of a Good Sheep Dog

are the same as those of a cattle-dog; steady, game, faithful, enduring, and intelligent. *Steady*, because a headstrong, disobedient dog will cause the quietest sheep to split and become unmanagable. *Game*, because a cow-hearted dog, on being corrected, will knock off work and slink behind the horses' heels or into the scrub, leaving the drover to work the sheep himself. *Faithful*, because if not he will take up with someone else, just when you want him particularly, as a rule, and the someone else gets about a fiver's worth of sheep dog at your expense. *Enduring*, because a dog that knocks up easily is no use to you, as you cannot keep a pack horse and a tank for his benefit. *Intelligent*, because a foolish dog is only a nuisance and discredit to you, and you are better without him.

As with cattle-dogs, you must suit your dogs to the class of sheep you have to handle, and, to some extent, where you have to handle them. For wild sheep in big paddocks, especially with merinos, a very wide-working, silent dog is required, with great speed and stamina, lightly built, and, if possible, a little on the small side. For quieter sheep, in smaller paddocks, a dog which works fairly close and

barks a little is the best. For yard work, penning-up, and trucking, a thick-set, lively dog, with any amount of voice, is essential, one that will run over the sheep's backs and force them about with plenty of barking and snapping. With most crossbreds and long wools I prefer a dog of the lastnamed sort, as the English sheep we mostly get here, such as Lincolns, Romneys, &c., unlike the merinos, have no nerves, but make up the deficiency in pigheadedness. To be a good worker a sheep-dog should be able to work either side and the tail of a mob, or both sides if the drover minds the tail; should be able, if the drover has to go ahead to open gates or slip-rails, to bring the mob along after him; to keep a mob rounded up anywhere if the drover wishes to leave them for any purpose or to draft. If kept for show purposes he ought to be able to work, as the saying is, "a chicken into a jam tin," or "a lizard into a pickle bottle."

In breaking-in a pup, every man has his own ideas on the subject. Personally, I prefer to break in a pup with an old stager on whatever class of sheep I would require him for. Before starting to break him in on sheep, however, I put him in a fowlyard for a few days, and keep an eye on him. If he comes of a good working strain it will not be long before he starts working the fowl or fowls into a corner and out again, till further orders. Then take him from the fowls and start him on the sheep. To teach him to sit down, if unwilling to crouch, hold him firmly by the neck with one hand and slap him heavily on the back with the other, till he learns to flatten out to avoid the strokes, at the same time telling him to "sit down," till he grasps the idea. (Keep a firm hold of his neck or he may grasp your hand as well.) Another way is force him down by both ears. When breaking always keep a light collar on him, so that he is more easily held when you want him, especially for correction, as you will have a nice job to catch him again if you are tanning him for disobedience and he gets away in the middle of it. When off duty be very careful to keep him on the chain, or he will nearly always amuse himself by sneaking off to the nearest mob of sheep, and working them almost off their feet for practice. Never allow anyone to feed or handle him but yourself. Remember that breaking-in a dog is like breaking-in a colt, and handle him accordingly; if of a lazy, stolid disposition, a little correction at times will improve him, whilst, if of a nervous, eager disposition, roughness will cow and ruin him. Never correct a pup with the whip or handle, or you will make him whip-shy, and spoil him for working with a whip. A green light switch, or a throat lash, and not too much of it, is the best, but whatever happens he must be brought thoroughly under control; if not he is no use to you, and you are foolish to keep him. If too eager, as sheep pups mostly are, either use him on big mobs, where he has to cover a lot of ground, or put a heavy collar or chain round his neck to restrain his youthful exuberance.

A very good plan (in theory) is to send him away "down the river" with a drover who is taking a big mob away. He will thus get steady work for some months, and return a sedate, A1 worker. This would be a fine method if the owner could insure him before

starting at his full future value, as it is really wonderful how liable such promising pups are to accidents when sent on the road in this way. If there is a bait within fifty miles they seem doomed to find it; is there a dog on the trip trodden on, run over, cut in pieces by the trucks, struck by lightning, drowned, scalded, or committed suicide, be sure it will be your pup. If afterwards, in another district, you come across a fine working dog which seems to know you, and which bears a suspicious resemblance to the one you sent away, well, "Dorgs is very much alike, an' me brother bought 'im from a drover at Bourke an' sent 'im to me." The thought that the drover you committed him to has paid for the flash Flinders saddle he sports with the proceeds of your pup, is too base to be tolerated, especially as two of his mates saw the pup expire, and actually cried over him, they had got so fond of him. No, this plan, like sending young dairy stock away for cheap grass, does not pay as a rule. Train him to avoid strangers as much as possible, as a fawning dog can always be stolen; if he has the habit of fawning on strangers, get them to give him a sharp lick or two till he associates the idea of a stranger with this treatment, and has too much respect for his skin to go near them.

Always use good, light, English leather collars if possible, and light, short, steel chains. Cheap gear is the dearest in the long run; always carry a wire muzzle, if travelling, to save him picking up baits. If you leave him anywhere with your horse in street or yard, tie him up near the horse; he is then not quite so easy to steal.

Varieties.

The classes of sheep dogs I am acquainted with in New South Wales are as under, in, from my experience, their order of merit as regards usefulness:

Barbs and kelpies	Mongrels and crosses
Smooth-haired collies	Rough collies.

I have placed barbs and kelpies together, as they are both equally good, though in my opinion they are now two distinct breeds.

The Kelpie (black and tan) is a dog a little smaller than a smooth-haired collie, and usually of a much finer bone. They are grand dogs for wild sheep, as they instinctively keep very wide when working and never split them. Will not stand scolding or beating, as they are of a very nervous disposition, and once cowed, are generally useless afterwards. At paddock work they are silent, but will bark if used for yard work. The points I give are what I consider a typical dog should possess, with some allowance as to build, depending on what class of country they are in, working in hot dry country requiring to be light of bone and coat, whilst one in colder country, with quieter sheep, would require to be stouter in build and thicker in coat.

Head, wide and flat between ears, tapering to a point at muzzle with light jaws.
Ears rather long, with fine leather, but pricked and running to a point at tip, without the least suspicion of floppiness, set wide apart on the skull, and inclining outwards rather than forwards.
Eyes, brown, quick and eager-looking.
Shoulders, light and well-shaped for speed.
Legs, clean, fine muscular development, light bone.

Back, straight, with good loins.
Hindquarters, light and muscular, with back thighs well let down for speed, no dew claws on feet.
Height, about 20 inches—bitches a little smaller.
Coat, short, smooth, and fairly dense.
Colour, head black, with tan spot over each eye, body black with sometimes white blaze on chest, legs black with tan points.
Tail, black, slightly feathered.
General appearance, that of a small prick-eared black and tan smooth collie.

The Red Kelpie.—Is of a red or brown colour, instead of black and tan, generally with hazel eyes, a little stouter in build than the black, and a good deal hardier, and will stand punishment, but is rather headstrong. As in the smooth collie, the blue colour crops up occasionally, and are generally very fine workers. Mr. Quinn, of Stockinbindyal's "Coil" is a notable example.

The Barb.—Is a black dog, sometimes with white blaze on chest, with either prick or drop ears, varying in size from that of a black and tan terrier to a big collie, and are of very uneven type at the present time, some being nearly as woolly as a rough collie, and others as smooth as a greyhound. They are hardier as regards rough treatment than the kelpie, and many of them will use their teeth on sheep if not watched when working, and are as a breed rougher with sheep, and not so tractable. The standard I would breed to is the same as for the kelpie, except for the colour.

Smooth-haired Collie.—I have only seen a few of these about, the best being called the Tully strain, called, as far as I can ascertain, after Mr. Tully, of Nelyambo, who imported them. Those I have seen were good yard workers, but too noisy and heavy-coated for paddock work.

Crosses and Mongrels.—I have seen some remarkably good ones of these, but, like anything elseof doubtful origin, they are too risky to breed from, as the pups are generally a conglomeration of all the other breeds, and it is impossible to say what they will turn out.

Rough-haired Collie.—I cannot express in this paper my full opinion of the rough-haired show bench collie as a worker, as I am afraid it would render the Editor liable to six months imprisonment for printing it. As an expert at hunting rabbits or hares, finding the nearest shady tree or tank on a warm day, splitting sheep, frightening them to death with his never ceasing baritone voice, and making a general nuisance of himself, he takes the palm. That is my experience of him in ordinary country; I have never worked sheep in snow country, so possibly he might be some use there with English sheep, if the drover using him were deaf, and there were no game about.

Importance of a Standard.—Whilst freely admitting that they work well in all shapes, still I would like to see a standard set up whereby we could get evenness of type, and thereby have some guarantee when buying a dog that he is from a pure strain as represented. The standard should be based on the shape the dog should be for his work, and the colours insisted on as a guarantee of purity. A stud-book in this connection would be invaluable, and I hope to see one established shortly, as with the blue cattle dogs. Judging the dogs at shows without a standard is a farce, as the judge gives the award entirely at

his own caprice, and there is no check on him. At the Royal Agricultural Show it is a matter of disgust to me that the prizes for sheep and cattle dogs are so small, just about paying train fare, which renders it prohibitive for a poor man to show there, and I would respectfully suggest to the management that the prize money in these classes should be increased, and more classes of them made, or these two sections be wiped out altogether, and the benches left to terriers, poodles, blood-hounds, and so forth, which may be ornamental, but are certainly no use to the farmer. The need of a good dog house is also painfully in evidence at the Royal Ground, the present cavern being unfit to bench a native cat in. If the management of the Sydney sheep show would give any encouragement to breeders by giving prizes for sheep and cattle dogs only at their annual show, dogs to be benched and judged on points, I am satisfied that they would be pleased with the result. It is this lack of standards to which, in my opinion, is attributable the awful quantity of nondescripts we have in this State at present, as there is little or no inducement for a man having good dogs, unless he is like myself, an enthusiast on the subject, to breed to type.

Registration.

This has always been a source of annoyance to me, small though the amount is, as I cannot see what earthly benefit the dogs derive from it. I think that in a pastoral country like this every person owning or handling stock should, up to either two sheep or cattle dogs, be exempt from the tax, as is the case in England. At the same time, I would like to see a compulsory system of registration—by marks and description—enforced (tattoo marks for preference), so that stolen dogs could be traced and sheep killers identified.

Origin of the Barb and Kelpie.

For some years I, like many others, believed that they were a cross of the smooth-haired collie and dingo, but after making exhaustive inquiries find that they originated thus: About 1875 Mr. Allen, of Jeralderie, imported a dog named Brutus and a bitch called Jenny from Scotland, prick-eared, smooth-haired, black-and-tan collies. One of their progeny was a dog called Moss, a black, prick-eared dog, with white blaze on chest. Mr. C. J. W. King, then managing Wollengough Station, Humbug Creek, Condobolin, had a fine, prick-eared, black-and-tan bitch, called Kelpie, also the progeny of Brutus and Jenny, which he mated to Moss, and one of the pups went, as usual, to the owner of Moss, Mr. P. J. Cox, of Murengrien. This pup was called Barb,—he was a black dog with prick ears. Mr. Cox gave him to a coloured man, who sold him to Mr. Edols, of Burrawong Station, where Barb got many good pups, and the progeny were called after him. Mr. A. E. M'Leod, of Wilgar Downs, tells me, in an interesting letter, that they (himself and Mr. King, nephew of the owner of Kelpie) have always kept the strain pure, tabulated pedigrees, and have never used any outcross. He says that they always sell

a coloured pup, as they find them too rash for show work. It will thus be seen that the barb and kelpie did not originate with the dingo; but I think myself, from careful observation, that some of their descendants, in careless hands, have got a cross of dingo through them.

I am experimenting with a couple of barb bitches now, crossing them with a fine pet dingo I have, to see what they will produce, as I know from experience that the dingo cross has produced some splendid workers. The wild head, coat, and brush of the kelpie may be due to a fox cross, as the gypsies cross with him in England notoriously.

(*To be continued.*)

SOME SO-CALLED FODDER-PLANTS NOT ALWAYS EDIBLE.

[Previous reference, *Agricultural Gazette*, August, 1903, p. 765.]

THE following letter from Mr. T. E. Grigg, of Fareham, *via* Girilambone, is interesting. The specimens he sends are those of *Eucalyptus bicolor*, A. Cunn. (of which *E. largiflorens*, F.v.M., is a synonym). I only wish to say that botanically the two specimens appear to me to be in every way identical.—J. H. MAIDEN.

"I promised to send you some specimens of the Edible Box (Coolabah), but, owing to the splendid season we have had, causing the trees to be loaded with leaves, I thought it best to wait till the sheep took to the leaves again, for I wanted to be sure of my specimens. I am sending down two samples. No. 1, as you will see, is just as the sheep left it, for they ate nearly every leaf, but did not touch the seed. No. 2, you will see, has not been touched. Now, what makes this so interesting to me is that there is splendid grass and salt-bush in the paddock, and quite close to these trees there is a swamp and plenty of green grass. I do not understand why the sheep will eat the one and leave the other; the conditions are the same. There are the two trees quite close together; one the sheep have cleaned up, and the other they left. To me this seems only the opening of a big question. For instance, is there something lacking in the ordinary diet? Do the sheep get a something out of specimen No. 1 that is necessary for their health? If not, why do they eat it? I know that the stock-owner will say, 'Oh, they only want a change'; but that does not satisfy me, for in the paddock that these sheep are there are blue-bush, cotton-bush, and fully twenty varieties of the best of our salt-bushes, besides a splendid variety of grasses. I have marked these trees, and if you would like specimens at any time I can easily send them down. I intend to try the sheep with these two trees again later on. I may say that the way I try them is to lop a limb and suspend it to the butt of the tree, and leave it till next day, and then, if the sheep have eaten it, I know that it is under ordinary conditions."

The Planting of Sandy Plains to prevent drifting.

[From the *Bulletin de la Société Centrale Forestiere de Belgique.*]

SEVERAL provinces of Russia contain large areas of shifting sand. This, when dried by the sun, is carried by the slightest breeze and deposited thickly on the adjacent cultivated fields. One of the main causes of this calamity is the destruction of the forests in order to clear the land for cultivation and pasture.

When a vast forest, which keeps the sandy soil cool and compact, is changed to an arid plain, dried by the sun and deprived of all vegetation, the wind having no obstacle to encounter, raises clouds of sand, and carries them to a considerable distance, and the result is a disastrous change in the climate and normal conditions of the country, having fatal consequences for agriculture. In 1840 to 1850, attempts were made in Russia to remedy this evil, and the Governors of the Provinces issued orders to the Forestry Departments to find means to fix the drift sands. This resulted in some insignificant experiments, which were, however, entirely abandoned when the serfs became free. When the matter was discussed before the *Zemstwost* several members of the assemblies insisted that the work should be resumed immediately, but their opinion was not supported by the majority. The price of land was at that time very low, and any expense incurred in improving it was considered unnecessary and useless. Moreover, such members as handled the question had no notion of the cost of the work, nor of the manner of doing it, and the discussions became abortive.

Certain landed proprietors and communes made some attempts to fix the soil by sowing oats or by planting sand-willows, but these isolated efforts lacked system, and did not go to the root of the evil.

The Minister for Lands did not appear to attach any importance to the matter, and only interested himself in the most urgent cases in certain localities. Thus, from 1870 to 1975, in the neighbourhood of the towns of Libau and Vindau, the dunes along the Baltic were planted to the extent of about 9,500 acres and in 1880 the vast arid Crown lands round the town of Narva, adjoining the dunes, were taken in hand by the Government of St. Petersburg, and one plantation of 500 acres was made in 1893.

In 1888 the Governor of Astrakhan forwarded a report to the Minister for Lands, urging the necessity for fixing the sandy steppes of Narinsk; and in 1890 the Forestry Department planted sand-willows and also attempted to consolidate the soil by sowing certain herbaceous plants. The inhabitants were forbidden to use these plains for pasturing cattle.

Proper attention to the subject was given by legislation for the first time in April, 1888, when certain regulations were put in force to preserve the Crown forests, as well as private ones. This enactment referred to :—(1) All forests or bush land having sandy soil, or which served as a defence against drift sands, along the seaboard, rivers, canals, or artificial reservoirs; (2) Those forests which protected towns, villages, railways, roads, cultivated fields, &c.; in fact, all vegetation the destruction of which might contribute to the formation of drift sand. This law, however, only referred to existing forests, and no attempt was made to deal with the enormous area of sandy plains which had already been formed.

The matter was left in abeyance until 1891-1892, when a terribly dry summer occurred, followed by bad harvests in most of the provinces of Russia. This calamity drew the attention of the administration and of local Governments to the bad state of agriculture and the causes which led to it, one of which was the constant extension of the area of drift sands.

In order to ascertain the best means of preventing this, the Minister for Lands and Agriculture addressed a series of questions to the local Governors and Chief Inspectors of the different districts. The replies showed that the area of drift sands in Russia in Europe was 12,845,000 acres, of which 9,658,000 were part of the Calmuck steppes of Kirghiz; 2,739,000 acres belonged to the towns and villages; and 448,000 to private owners. The main part had been formed where trees and shrubs had been destroyed to make pasturage of the sandy plains; and neither the communes nor private owners had taken any steps whatever to stop the extension of the drift sands.

The Minister for Lands and Agriculture declared that it was absolutely necessary to start, immediately, willow-planting on the sand-plains in Astrakhan and 16 other provinces. The choice of these localities was made to enable private owners to obtain easily, and at a low price, the necessary plants. The Forestry Department also desired that these first operations should serve as an example to the inhabitants, so that future private plantations should be made in the best and most systematic manner.

When, in 1897, the planted area extended to 5,000 acres, the provincial authorities were ordered to transplant the willows and deliver gratuitously the first plants to all communes or private owners who guaranteed to use them for fixing the drift sands.

The Minister for Lands also drafted a bill embodying the measures to be taken for the fixing of the drift sands, and also for preventing their formation. This bill, after having been submitted to and discussed by the Land Committees, was transmitted to the Council of the Empire, which began to take interest in the matter, and consented to the proposal for remedial measures to be taken by the State, and instructed the Minister to examine the question thoroughly. The bill was slightly altered in conformity with recent experiences, and will soon be put in force. Whilst gathering all necessary information for the execution of the Council's mandate, the Central Committee of the Forestry administration started practical measures for fixing the drift

sands as far as the power granted to the Minister admitted. Several officials visited the affected localities, and the work was organised in eight provinces. The Forestry Department took charge of the technical part of the work, and plants, seeds, &c., were supplied free to any private owner of such sand-plains. The local authorities also granted subsidies for the transport of materials, purchase of tools, appointing of overseers, and petty expenses. The planting and caretaking was, however, at the expense of the owners. The pupils at the elementary forestry schools, which were located in the neighbourhood, took part in the work in the spring and autumn. The general superintendence of all these operations was confided to the Chief Inspector of Forests, M. Kostiajeff, who has specially studied the best means of fixation used in other countries as well as in Russia, and who possesses a thorough knowledge of the subject. An engineer of the Forestry Department has charge of the works in each province. Sub-engineers from the same department attend to the works in the various districts of the Provinces, analyse the sandy soil, consult with owners, and draw up reports on the progress of the work for the local authorities to obtain the necessary subsidies. They also organise the transport of materials, assign the different jobs to their surbordinates, and superintend the planting. The subordinates survey and analyse the soil, and look after the labourers. When analysing the soil, a plan of the plain is first drawn up, and the quality and thickness of the soil to the diluvial strata, as well as the nature of the vegetation, is ascertained. All the arborescent plants are very carefully examined. The territory planted must be carefully guarded against the invasion of cattle. The local authorities have to purchase the necessary tools (Eckerts' ploughs, dibbles, shovels, &c.) for the work of planting. The Inspectors of the Forestry Department visit the plantations regularly in the summer, and give minute instructions as regards replanting in the autumn or spring such parts as have suffered from drought or storms. The cutting down of the willows in the new plantations is only done in the third year.

The functionaries of the Forestry Department have also to give popular lectures on Sylviculture in the surrounding districts, to spread an elementary knowledge of the same, arrange exhibitions, and give any information desired.

The nurseries on sand-plains belonging to the Crown can now supply sufficient material to the private owners, and five years' work (1898 to 1902) has sufficed to complete the system.

The consolidation of the soil on mountain slopes, in bogs, and other places unsuitable for agriculture has also been started recently on the same lines. From 1898 the staff employed has rapidly increased from two to 44 engineers, 12 superintendents, and 22 pupils from the forestry schools in 1902. The area of drift sand-plains planted with willows, black poplar, white acacias, and other species of trees was 2,500 acres in 1898, 10,000 acres in 1899, 12,000 in 1900, 32,000 in 1901, and 27,000 in 1902, or a total of 83,500 acres. The officials demonstrate to the proprietors of sandy plains the advantages and necessity of these works, and a large number of plantations have been established by private persons, 92 in 1901, and 320 in 28 districts in 1902. At first

only willows were planted, but, since 1900, pines, black poplars, birch, white acacias, and other species have been employed. The Crown nurseries for this purpose have also been greatly extended.

The annual subsidies offered by the local authorities for the planting of sand-plains have increased from 2,500 roubles in 1900 to 40,000 roubles in 1903. The total cost of planting 83,500 acres in five years amounted to 600,000 roubles (about £48,000), of which the State contributed 220,000 roubles, private owners 320,000, and local authorities 60,000 roubles. This represents a cost of about 11s. 6d. per acre, of which 3s. 6d. is for plants and materials, &c., and 8s. for labour.

An important start has been made, but much remains to be done, as there still exist 11,250,000 acres of such sandy plains. The utility of the work has been indisputably proved, as the want of good land is being more and more felt in Central Russia (whence numerous families are emigrating to Siberia) and this part is just the one principally affected by drift sand, and where many thousands of acres of good land are annually devastated. An example will demonstrate this. The village of Téréchowo (in the Nijnidievitsk district) had in 1802 only 400 acres of sand, which since have increased to 4,400, and in the dry summer of 1901 the drift sand covered and destroyed 190 acres of wheat.

According to recent statistics, the drift sands increase annually from 1 per cent. in the Province of Voronège up to 5 and even 8 per cent. in some districts. This shows conclusively the necessity for stopping their progress by means of plantations. The transformation of arid plains of sand into forests will pay well, and will alway add to the national prosperity. The subsidies granted by the law of 26 February, 1901, for sylviculture have greatly helped to effect the consolidation of these sands, and apply to any species of arborescent plantations established for the same purpose.

Protecting Young Fruit-trees from Hares.

Mr. Philip Winchester, of Kentville, Cullen Bullen, writes:—A couple of years ago hares were very troublesome at my place, barking many apple-trees, and some pear-trees 8 or 9 inches through. I think the drought caused them to be worse that year than in previous years, and cow-droppings and lime, which I had applied with success before, was of no value. I therefore mixed equal parts of boiled linseed oil and Stockholm tar, and painted the trees to about 3 feet up from the ground. At first the hares took out a small piece of bark the size of your finger-nail from several trees, and then left them alone. The dressing appeared to do the trees good. Trees half an inch through can be dressed without in the least damaging them.

Co-operative Agricultural Societies.

THE following is a copy of a Bill introduced by M. Clementel in the French Parliament to provide for Co-operative Agricultural Societies:—

Constitution of the Societies.—Any agricultural trading syndicate can form co-operative societies for storing, handling, and sale of the agricultural produce of its members, and for the purchase of articles necessary for the professional wants of its members, but the operations must be carried on exclusively for the benefit of members.

Capital and extent of liabilities.—The capital of such co-operative societies must not be raised by transferable shares, but by nominative shares, subscribed by the syndicate which has formed the society, or by any other association or society approved of by the syndicate, and the shares must be fully paid up. A co-operative society can be constituted without any capital. The responsibility of the shareholders towards the trade creditors may be nil, or limited to the amount of the share, or to a multiple of this amount, or it may be unlimited. The statutes of the society must clearly indicate if this responsibility is individual or collective.

Publicity.—Before any operations take place, the statutes with a complete list of the administrators or directors, and of the shareholders, giving their names, professions, domiciles, and the amount of each subscription, must be sent in duplicate to the Chief Inspector of Agriculture of the province in which the society has its head office. Before February 15, in each year, the society must send to the same official a duplicate list of all new or resigned members, and balance-sheets, showing receipts and expenditure, as well as the transactions effected during the preceding year. The Inspector must see that these documents are published in the local newspapers, and sent in duplicate to the office for information of the Minister for Agriculture. These documents must also be accessible at the head office of the society to any person desirous of consulting them, and copies given to anyone requiring them, either gratis, or at a small charge. All papers emanating from the society must mention the nature of its trade, the amount of capital paid up, and the total responsibility assumed by the members, giving the date to which these details refer. Any alterations in the statutes must be published in the same manner as the statutes themselves.

Admission, retirement, or exclusion of members.—The transfer of shares can only be made to members of the syndicate to which the society belongs. The directors can refuse the transfer until submitted at a general meeting. When the interest of a deceased shareholder devolves on a person unsuitable to take part in the society, the value

shall be paid to him, and he assumes no personal liability. Any shareholder can retire from the society at any time, and obtain payment for his shares. The capital must, however, not be reduced by such resignations below the original amount indicated in the statutes. The council of administration, or directorate, have the power to exclude any member for a grave reason, without submitting the matter to a general meeting, but must pay him the value of his shares. The exclusion shall be compulsory as regards shareholders who cease to belong to the syndicate to which the society is annexed. The repayment of the shares shall be at a rate fixed every year by the general meeting, and shall not exceed the original amount paid. Every retiring, deceased, or excluded shareholder shall be liable for his engagements to the society, and to third parties, by reason of the transactions of the society up to the close of the audit. The actions resulting from this obligation shall be limited to two years after that date.

Organisation of the Society.—The general meeting shall be composed of all the shareholders, and the statutes must fix the majority required in voting to carry decisions. When all the shares are taken up by one syndicate, the general meeting will be that of the syndicate. When all the shares are taken up by two or several syndicates, the statutes shall indicate that the general meeting is constituted by proxy representatives appointed by the syndicates. The general meeting appoints a directorate, which must present a balance-sheet each year.

Appropriation of funds and profits.—The directors shall fix certain rules as regards the profits to be charged on the transactions of the society, and such profits are to be applied to—

1. General annual charges.
2. Payment of annual interest to the shareholders, the amount of which shall be fixed at the general meeting, but must not exceed 4 per cent.
3. Formation of a reserve fund.
4. Payments of trade-creditors and shareholders.

The surplus shall be credited *pro rata* to the accounts of the shareholders, and shall not be paid as a dividend in any form whatever. When the society is dissolved the reserve fund and other assets shall be used for the payment of all trade-creditors and shareholders. The surplus becomes the property of the syndicate to which the society belonged; if to several syndicates, the statutes decide the mode of division.

Repayment of shares.—When the reserve fund has become equal to the original capital of the shares, these can be repaid, but still carry the same liability.

Inspection—Unions.—The transactions and books of the co-operative societies must be audited at least once a year by the auditors appointed by the Minister for Agriculture, or, if isolated, by the Chief Inspector of the province. If the society is affiliated a union of associations or agricultural societies, the auditor is appointed by such unions. The auditors are granted every facility and power for carrying out their work, and are paid by the society. The co-operative societies may

form themselves into groups or unions on similar lines. The statutes must fix the number of votes accorded to each society at the general meetings of the union.

Legal status.—The co-operative societies defined by this Bill are subject to the laws and usages of commerce.

Penal provisions.—It is forbidden for any person or society carrying on the operations defined by Clause 1. and who do not conform to the operations of Clause 6, to assume the name or title of Agricultural Co-operative Society, or a title which might lead the public to suppose that they followed a disinterested trade. Any offender against this clause shall be prosecuted by the Government, and fined from 5s. up to £20.

Financial aid from the Government.—A sum of £200,000 to be granted as advances, without interest, to co-operative societies constituted in conformity with this Bill, for the purpose of building and fitting up stores for agricultural produce. The distribution of these grants to be decided by a committee on which three members must be represented by the societies organised for the collective sale of agricultural produce. The amount of the advances must not exceed four times the capital paid up or double the liability assumed. When the advances are used for building purpose, the Government shall hold a mortgage on buildings and fixtures, to be stated on the receipt form for these advances.

Treatment for Anthracnose or Black-spot of Grapes.

Mr. B. Hall, of Lindaville, in commenting on the statement of the Viticultural Expert to the effect that no treatment after the appearance of the disease on the berries would be practicable, and that the only effective means of protecting the crop is by means of the winter dressing of sulphuric acid, points out that there are growers who consider that anthracnose can be checked *at any stage* by the application of Bordeaux mixture. Mr. Hall states that in the early part of December he saw two growers in his district spraying a beautiful lot of vines, Late Sherry, which were quite free from disease. Upon inquiring the reason, he was informed that the spray was being applied with the object of preventing the development of the Black-spot. They further stated that through not keeping the pump going last season, even when the berries were as large as peas, a couple of hours' rain produced such a crop of Black-spot that the vines returned only four cases where they anticipated 200.

At his own place, Mr. Hall says he had not had any Black-spot for the past six years, and consequently was not expecting any, but owing to the humidity of the season, the disease got a start, and before he

had noticed it several vines had been almost denuded of leaves. He started to spray. Result, immediate check. With further rain the spot developed again, and was checked with the spray, the vines acquiring a new growth of foliage. During the early part of December two thunder-storms were experienced, and each time the spot developed and was checked by spraying. Concerning the winter dressing, Mr. Hall does not consider this half as effective as the spring dressing. His neighbour gave his vines two very strong dressings in the winter, and they were worse in the following summer than ever before; but the bluestone checked it with him in the first application.

As to the statement of the Viticultural Expert that the *mycelium* of the fungus secreted itself in the old bark and the buds of the cane during winter, and came away in the spring with the young growth, Mr. Hall would like to know what became of the *mycelium* in his case during the last six years, as the spot did not develop until this season.

Mr. Hall's statement was brought under the notice of the Viticultural Expert, M. Blunno, who states that while there may be better remedies, up to the present there is not known any treatment that can be regarded as reliable for the prevention of Black-spot of grapes as the dressing of 10 per cent. solution of sulphuric acid applied at the proper time—just before the bursting of the buds. This treatment is the result of carefully conducted experiments with numerous substances and chemicals in many different seasons. When it fails, inquiries almost invariably reveal the fact that the application has been inopportune. While Mr. Hall's letter was in the office, Dr. Fiaschi happened to call, and the Viticultural Expert asked the doctor, as an experienced grower, whether he had found the Bordeaux mixture as a summer dressing effective against Black-spot. He said he had not, but had always had good results with the preventive remedy of a winter dressing. Mr. R. Scobie, of West Maitland, another competent vine-grower of many years standing, is now obtaining from France two specially-fitted spray-pumps for the application of the 10 per cent. solution of sulphuric acid as a winter dressing against Black-spot. In passing, it may be mentioned that in using this solution, ordinary pumps would be corroded in a few days, hence it is necessary to have the pump lined with a special composition that is not attacked by acids. Many of these pumps are placed on European markets. With reference to the vineyards around Elderslie, viz., that summer spraying would be of little use, the crop had been destroyed while the vines were yet in bloom, and no spraying could have possibly restored it. Enough leaves had been left to help the proper summering of the canes from which to choose for the next pruning. The question that is most material to the vigneron is whether, having lost his crop, he would gain anything by repeatedly spraying after every summer shower. In the opinion of the Viticultural Expert, he would not; hence the recommendation to the growers concerned.

ERAGROSTIS SETIFOLIA

Useful Australian Plants.

BY J. H. MAIDEN,
Government Botanist and Director, Botanic Gardens, Sydney.

No. 85. *Eragrostis setifolia*, Nees.

Botanical name.—*Eragrostis*, already explained; *setifolia*, Latin, *seta* a bristle, *folium* a leaf, in allusion to the narrow bristly appearance of the leaves.

Synonym.—*E. chætophylla*, Steud.

Botanical description (B.Fl., VII, 648).

Stems, from a shortly-thickened, almost bulbous, slightly woolly-hairy base densely tufted, slender but rigid, 6 inches to 1 foot high, often leafy to the inflorescence.

Leaves very narrow, convolute or setaceous, glabrous.

Panicle narrow, 1½ to 3 inches long, shortly branched.

Spikelets usually rather numerous, shortly pedicellate, scattered or crowded, flat and thin, 2 to 4 or rarely 6 lines long, 1 to 1¼ lines broad, six to thirty-flowered.

Glumes closely distichous or rather loose, ¾ line long, obtuse or almost acute, hyaline or purplish, the lateral nerve prominent on each side at the base.

Palea nearly as long, glabrous.

Stamens, three.

Grain small, ovoid-oblong.

Value as a fodder.—Inferior, because of its wiry nature. At the same time it provides useful feed when quite young.

Habitat and range.—Found in all the States except Tasmania. An interior species.

REFERENCE TO PLATE.

A. A specimen with short spikelets.

B. Part of inflorescence, enlarged.

C. A single spikelet.

D. Part of spikelet, showing the rhachis.

E. Flowering glume and palea.

F. A specimen with long spikelets.

G. A single spikelet.

H. Flowering glume, palea and grain.

No. 86. *Eragrostis leptocarpa*, Benth.

Botanical name.—*Eragrostis*, already explained ; *leptocarpa*, slender. The narrow grain, to which the specific name alludes, is characteristic of the species.

Botanical description (B.Fl., VII, 644). A bushy grass of about a foot high when in flower.

Panicle at first narrow, at length spreading with numerous much-divided capillary branches, the lower ones often clustered and in the larger specimens 6 inches long and the whole panicle 9 or 10 inches, in other specimens much smaller.

Spikelets narrow-linear, 2 to 3 lines long, loosely 6 to 12-flowered, pale-coloured and shining, glabrous.

Glumes very narrow, rather acute, $\frac{3}{4}$ line long, thin and hyaline, the lateral nerves not very conspicuous.

Palea nearly as long.

Stamens usually two, anthers very small.

Grain oblong-linear, sometimes very narrow and as long as the glume, in other specimens shorter.

Value as a fodder.—Nothing is definitely known of its value in this respect. It is probably only of medium value, but still desirable, because of its drought-resisting qualities.

Habitat and range.—This is a Central Australian species previously recorded from South Australia, Queensland, and Western Australia. Mr. Betche and I first recorded it from New South Wales,* Mr. J. W. Johnson having sent it from Olive Downs, Tibooburra, in the extreme north-western corner of this State. Since then, Mr. P. Corbett has sent it from the Paldrumatta Bore *via* Wilcannia, and doubtless ere long it will be sent from many other far-western localities.

REFERENCE TO PLATE.

A. Part of inflorescence, enlarged.

B. A single spikelet.

C. Spikelet enlarged, showing the rhachis.

D. Flowering glume and palea.

E. Grain.

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* Proceedings, Linnean Society, N.S.W., 1901.

ERAGROSTIS LEPTOCARPA.

Notes on New South Wales Weeds, including some new ones.

By J. H. MAIDEN.

In my capacity of Government Botanist, the determination of weeds and giving information concerning them have kept me very busy during the last few months. I have not time to make a formal weed report or even a list of all the weeds, but I submit a few notes which are worthy of wide attention. I may say that it is the opinion of a great many people that we have a Weeds Act in New South Wales. I know of none, and I warn people against reporting a weed to the Government as if there were nothing else to do. The elbow grease then commences. I do not say that all weeds should be eradicated, *e.g.* in the case of many with feathery seeds, belonging to the thistle family, it would be idle to attempt such, but many weeds should be carefully eradicated before they mature seed and conscientiously burnt.

At a meeting of the Royal Society of New South Wales, held on the 4th November, I made the following statement:—

Weeds.—These have made great headway during the present favourable spring, but it must be remembered that their presence, in many cases, is directly traceable to the drought. A number of weeds have been shown to be new to the State,* while others have made their appearance in districts widely separated from those in which they were previously found.† In many cases their presence has been directly traced to imported fodder.

The Cape Tulip (Homeria collina, *Sweet*) *in New South Wales.*

Mr. R. Baynes, of Fernhill, in the Penrith district, sends some bulbous plants in seed to the Department with the information that the plant in question is spreading, and that it is known to have caused the death of some cattle. It turns out to be the so-called Cape Tulip

* Mr. Maiden exhibited four bad weeds, not hitherto recorded for the State, which had come under his notice during the previous fortnight, viz. :—(1) *Amsinckia intermedia*, Fisch and Meyer, a yellow-flowered member of the Forget-me-not family, from Blayney. (2) *Adonis autumnalis*, Linn., the Autumn Pheasant's Eye or Red Chamomile, a pretty plant belonging to the Buttercup family. It is a European plant, and comes from the Berrigal district. (3) *Lactuca scariola*, Linn., "Prickly Lettuce," from Barraba, a weed difficult to cope with because of its feathery seeds, and which he had already received from Aberdeen and Wollongbar in 1899. (4) *Sisymbrium orientale*, Linn., a weed belonging to the Mustard family and native of South Europe. This also hails from Barraba.

† The Cape Weed, *Cryptostemma calendulacea*, R. Br., a Dandelion-looking plant, which has been sent this season from numerous New England localities as a stranger, was exhibited as an instance of a plant from widely separated districts from which it was previously found.

(*Homeria collina*, Sweet), a plant belonging to the Iris family, which has already a pretty extensive literature. It would appear from Mr. Baynes' letter, and also from the small sack of plants he has sent, that this plant has obtained a good footing. I am sorry for this, as it is undoubtedly a well-proved poison plant. An exhaustive pamphlet, "Report on a poisonous species of 'Homeria,'" by Mr. D. McAlpine, was published by the Department of Agriculture of Victoria, inasmuch as the plant has escaped from gardens near Melbourne, and has poisoned cattle. It is a well-known pest in South Australia, and there is an article on it in the *Journal of Agriculture of South Australia* for September of last year, p. 71. Apart from the abundance of seed (and the capsules of the plants now sent are full of it), it is propagated abundantly by the innumerable little bulbils (incipient plants) which the plant bears. I know of no means of coping with it except by carefully digging it up before it seeds. It is a pretty plant, and is an escapee from gardens. Zealous war should be waged on it. It seems to me that it has not been formally recorded as a weed in New South Wales, although I have been aware of its existence in gardens in this State for years. It possesses a facility for getting the wrong side of the fence.

The plant is also poisonous to human beings. See a case of death following eating of the bulbs (*Agricultural Journal of Cape of Good Hope*, October, 1903, p. 391).

Calvary Clover (Medicago intertexta, *Linn.*) *A new pest for the wool-grower.*

This is a Medick or Trefoil, with coarse leaves, say an inch to an inch and a quarter, and large fruits. My readers have noticed the little copper-coloured blotches in the common Medick (*M. denticulata*, Wilid.) figured in the *Gazette* for November, 1896. In the Calvary Clover the blotches are much larger and sometimes shaped like a rose-leaf. To these blotches the plant owes its name of Calvary Clover. The legend is that the plant grew at the foot of the Cross, and that the splash of our Saviour's blood caused the markings in question. The name of the plant is *Medicago intertexta*. I have received it from a correspondent at Manildra, and, since it contains the largest and worst burr of any of the Medicks known to me, I earnestly warn my readers against it. The burr is of the size of a large cherry. The pod is spirally wound up, as indeed are all these burrs, and when it is pulled out it resembles a centipede, being several inches long, and having innumerable spines. It is altogether a formidable pest.

A new grass.

Bromus rubens, Linn., a grass new for the State, introduced from the Mediterranean region. It is allied to *B. sterilis*, Linn., and although it produces fair feed when it is young, the long awns and rough glumes of the species render its room better than its company. It comes from Mount Ida, Whitton—how, it is hard to say—probably in feed.

Lessons of the Drought.

(Continued from page 64.)

Maitland Land District.

Mr. M. Barlow, Surveyor, reports:—During the drought, and since its breaking up, I have had opportunities of learning the experience gained by a good many of the leading pastoralists and farmers in the above-mentioned districts, and from such reliable information and from my own personal observations I give below, under the various headings suggested by the editor of the *Gazette*, the conclusions I have arrived at.

The Crops which resisted the Drought most conspicuously.—In all parts of this district, lucerne, whether irrigated or not, resisted the drought best, and in the northern part of the Scone district, prairie-grass was also found to resist the drought well, and Algerian oats stood well on the upper reaches of the Hunter.

The Grasses which stood longest, and which have been most quickly rehabilitated.—In all parts of this district, lucerne stood longest and recovered most quickly, and in the Muswellbrook and Scone districts couch-grass, prairie-grass, and all descriptions of trefoil stood longest and recovered most quickly. In the Merriwa and Cassilis districts (basaltic) blue-grass, kangaroo-grass, and barley-grass stood longest and recovered most quickly.

The Methods of Cultivation which effected the most striking results.—Irrigation was very successful in this district during the drought. Mr. J. C. White's "Edenglassie" irrigation farm, and Mr. R. T. Key's "Bengalla" farm provided valuable object-lessons for this district, showing the splendid results which could be obtained and the inestimable value of irrigation in times of drought.

In all parts of the district I observed that deep ploughing and frequent harrowing gave the best results; the good effect of frequent harrowing was most noticeable on lucerne crops.

Mr. W. E. Abbott, of Wingen, informed me that the drought did not in any way damage his old established lucerne or prairie-grass paddocks, and that they recovered much more quickly, and afforded good feed months before the native grasses; also, that all paddocks that had been ploughed stood better and recovered more quickly than uncultivated land; and he is of opinion that it would pay to cultivate native grasses, even if other grasses were not sown.

The breeds of Cattle which proved to be most hardy.—Devon cattle proved most hardy in the Scone, Cassilis and Merriwa districts; Herefords and Devons and Polled Angus in the Muswellbrook district; Durhams in the Singleton district; and Polled Angus in the Upper Hunter or Belltrees district.

The breeds of Sheep which proved to be most hardy.—Merino sheep proved the most hardy in the Scone, Belltrees, Merriwa and Cassilis districts.

The breeds of Horses which proved to be most hardy.—Thoroughbred horses, or horses with English or Arab strains, and Welsh ponies proved most hardy all through this district.

The effects of droughty conditions on Insect Pests.—It seems to be the general opinion in this district that the drought had no appreciable effect in checking insect pests, but rather that such pests retained vitality and caused more destruction on account of the debilitated state of plant life.

The effect of droughty conditions on Diseases.—In most parts of this district stock were very healthy during the drought, but in a few places aphis attacked horses and sheep badly.

The systems of feeding which proved to be most effective during the drought.—In the Singleton, Scone, Belltrees, Merriwa and Cassilis districts chaff and straw, with molasses, and chaff and corn fed from troughs, and lucerne hay fed in the paddock, proved to be most effective systems of feeding stock. Many cattle were kept alive by being fed on river oak, and sheep did fairly well on white box and ironbark. The chief lesson learnt was that feeding should be started before the stock get too low. In the Muswellbrook and Scone districts many dairy cattle were kept alive and in fair milking condition on boiled prickly pears, mixed with chaff or molasses.

It is generally considered in this district that molasses is a good substitute for green feed. In the Merriwa and Cassilis districts, on the basaltic soils, the wonderful rapidity with which the herbage and native grasses appeared when the rain came, although they apparently had not seeded for years, was very noticeable; many herbs not previously known in this district have appeared since the drought broke up.

The effects of the drought on afforestation.—I noticed that on stony hillsides and shallow soils all over this district many young white and yellow box, ironbark, and spotted gum trees died.

I noticed that all over this district marsupials (with the exception of opossums and kangaroo rats) died in hundreds, even where sheep were holding their own on whatever they could pick up.

Water Supply.—In the Upper Hunter district, Belltrees, Stewart's Brook, Moonan Brook, &c., the small springs and streams stood better than the larger ones, and the water supply was not so short as in many previous droughts. I noticed that when there was sufficient water supply, stock did well on dry feed, such as chaff and hay.

MR. S. R. BEATTY, Surveyor, reports:—In the districts where I was engaged upon field duties, viz., along the coast between the Hawkesbury and Manning Rivers, and extending for a distance of 30 to 40 miles inland, there was practically no drought; in fact, the whole of the coastal districts were favoured with such beneficial rains that the natural pasturage was on the whole good enough even at the driest times to not only satisfy local requirements but also accommodate many thousands of cattle and sheep sent for agistment from the less fortunate inland districts.

Upon a few occasions I was required by my official duties to travel through the Singleton and Upper Manning districts which, during 1901-2, suffered from partial drought, but upon each trip my visit was so short that I was unable to gain any definite information of value in connection with the proposed article.

In the Muswellbrook, Scone, and Cassilis districts a severe drought was experienced; all crops failed and great losses of stock occurred. My only visits to those districts, however, were made after light rains had fallen, so that the most severe conditions had been greatly mitigated and the effects of

the prolonged drought were only prominently brought under observation by the dryness of the watercourses and the paucity and poverty of stock.

In normal seasons the average rainfall of from 40 to 60 inches per annum is found somewhat excessive along the coast, both the pastoral and agricultural country producing the best returns in moderately dry seasons such as were experienced from 1897 to 1902, when the average rainfall was from 30 to 40 inches. Although a few places in the higher portions of the coastal districts suffered from the want of rain for a few months, they could not in any sense be referred to as "drought-stricken," their sufferings being only temporary; numerous running mountain streams afforded abundance of water for domestic requirements, and relief for stock could easily be obtained by the good pasturage available within easy droving distances. The only time when matters were at all serious throughout the coastal districts was during the autumn and winter of 1902. Owing to the light rainfalls in the previous spring and summer, the maize, wheat, and green fodder crops (barley, sorghum, &c.) were small, and the pasturage also suffered; but on the other hand the high prices realised to a great extent compensated for the smallness of the crops. Also, this district throughout the whole of the dry seasons contributed very largely to the supply of fat stock for the local and Sydney markets. As the result of inquiries made from agriculturists, pastoralists, and managers of financial institutions, it would appear that the majority of the producers in this district, by obtaining the highest prices for their produce and stock, and by taking for agistment, at greatly enhanced charges, thousands of starving stock, may be said to have benefited by the misfortunes of others in the drought-stricken districts inland.

The four most prominent matters which have come under my observation in connection with the drought are:—(*a*) Owing to the want of surface water and soakage therefrom, the numerous springs and wells used for the watering of stock on the lower-lying lands became either very brackish or salt; also large areas of lucerne on the alluvial flats were killed by the salt water affecting the roots of the plants. (*b*) During the years 1901-02 there was an almost complete failure in the growths of the red and white clovers; these grasses, however, re-established themselves when heavy rains were experienced this year, and they are now growing luxuriantly. (*c*) Large tracts of open marsh and moorland, which in ordinary seasons afford rough, coarse pasturage for cattle, were altogether useless during the dry weather. (*d*) Since the break-up of the drought, the whole of the Lower Hunter and coastal districts have been infested with "Cape weed." This pest first made its appearance in these districts after the drought of 1888, but was seen in only a few isolated spots until 1895, when it disappeared; during the autumn of this year it reappeared all over the districts and spread so rapidly over the richer portions as to already greatly depreciate the pasturage, and it now threatens to ruin (at least temporarily) large areas of valuable grazing country. As it was not known as a noxious weed in this district prior to the break-up of the recent drought, its sudden appearance in such larger and luxuriant growth is probably traceable to the great traffic during the drought by stock travelling from the inland districts to the coast for pasturage.

MR. C. H. LANGLEY, Inspector of Conditional Purchases, Taree, reports:—

Grasses.—In the part of the Western district where I was working I found that the Johnson grass, foxtail, and a grass that goes by the name of "red grass" out there, were the best. The variegated thistle was the only fodder plant to my knowledge; it is fairly drought-resistant, and the stock feed

readily on it either in a green state or when cut and let to lie; it would also make a good ensilage mixed with other grasses, but the quantity of it is limited, as it chiefly grows on the banks of the Macquarie. The paspalum, which is being grown in the coastal district and thought highly of, I do not think would be a success in the Western districts, but the chief grasses here to stand all weathers are the couch and bully-couch, besides the paspalum.

MR. E. A. HARRIS, Surveyor, Maitland, reports:—During the last three years my duties have been confined chiefly to the counties of Durham, Gloucester, and Macquarie, a part of the State which the late drought visited less severely than almost any other; the effects therefore have not been so severely felt, nor are they so apparent as in less fortunate districts, the consequence being that settlers have learned but little to guard against the effects of any future drought. On a few holdings coming under my notice action has been taken to store surplus water in the back paddocks, but the practice is the exception, whereas it should be the rule. Very little effort is made to store hay or grow root crops for feeding stock in winter, and ensilage is an unknown quantity.

Grasses.—Some attention is being given to supersede the natural grasses by sowing others, chiefly cocksfoot and clover, though in the Comboyne Brush the settlers seem to prefer perennial rye grass, but throughout the district paspalum is coming into favour. It is easily propagated by dividing and planting the roots, and the seed germinates freely in favourable soil with plenty of moisture, but is apt to fail in dry seasons. When established it appears to be hardy, prolific, and relished by stock.

Ringbarking.—Much of the poorer grazing land of the district can be much improved by judicious ringbarking and clearing, but owing to the tendency to sucker and seed, the undergrowth requires attention for five or six years, which means much labour or considerable expense. If this work is neglected, ringbarking generally does more harm than good. Much of the success of the operation depends on the season chosen. The most favourable time is found to be when the sap is fully up, and preferably after a wet season.

Prior to the last three years I was employed in the far west and south-west, and have had much experience of that country in all seasons, and witnessed the disastrous effects of the windstorms on the drought-stricken bare plains. Much of this is due to overstocking in the early stage of the drought, aggravated by the advent of the rabbit. That it is not due to the drought and rabbit solely (as is generally alleged) I have frequently seen unmistakable and undeniable evidence. Loss of stock in time of drought could be greatly minimised, if not entirely avoided, by adequately storing the surplus supply in good seasons. At the present time there are thousands upon thousands of tons of grass and herbage going to waste, which could, and should, be stored away in the form of ensilage, which could be kept for an indefinite time, and increased as opportunity may occur. Although so important to graziers and settlers generally, the making of ensilage and its advantages are subjects of which few have any practical knowledge, or take any interest in, the general opinion being that it is not worth the trouble, that the expense is prohibitory, and difficulties overwhelming, and fail to realise that it is practically imperishable from fire or weather, that when made it is available for any emergency at any time. The storing of ensilage is, to my mind, the most important lesson to learn from the late drought, though the conservation and distribution of water should be actively pursued and developed, both by the State and individual effort.

Richmond River District.

MR. C. H. GORMAN, Manager, Wollongbar Experimental Farm, Richmond River reports:—Like other districts this particular part of the State was visited by exceptionally dry periods during 1902-3, but unlike many other parts the effect was not so serious and the word drought cannot be properly used. Old records go to show that the season was the driest experienced for the last fifty years and it was not pleasant to bear, but it is remarkable how quickly the district recovered. During the latter part of last year and the early part of the present year the outlook was anything but cheerful and many were beginning to wonder what was going to happen. Crops were looking bad and were being fed off to stock long before maturing, and even the pastures looked parched and burnt; but the response to a few points of rain was encouraging and showed that with anything like ordinary treatment the district would not be so badly off. It came to many that they were carrying too many stock and the next move was the disposal of the surplus. Fortunately buyers of fat cattle were around and good prices were obtained. I do not think that many farmers will in the future run the risk of overstocking on account of the lesson learned during the period under review. In past seasons there has always been an abundance of feed, in fact more than was required, and the thought of a stand-by had occurred to very few. This was another lesson learned, and one could hear the remark often expressed that no one would be caught napping again. Provision must be made for similar occurrences in the future even though such an experience may not be visited on us, and in making the provision the silo must be looked to as the best means. Some few farmers had gone in for ensilage and there is no doubt that they, at any rate, will not be without again. When it is considered that ensilage can be made from anything and that it will keep for years and years, it is a wonder that more attention has not been given to it. I am often told that it has never been necessary to look to hand-feeding, but that is no reason why a supply of ensilage should not always be on hand. It is known as one of the finest milk-producing feeds and for that reason alone more thought should have been given to it. At this farm a stack was made of maize, sorghum, millet, and lucerne, and turned out well notwithstanding that the most primitive means were adopted in its manufacture. The cattle improved in every way while being fed with it. The greatest rubbish can be turned into ensilage and it behoves every farmer to look ahead and arrange to have a stack or pit.

Grasses.—During the dry weather all the grasses were thoroughly put to the test and points were learned about certain grasses that under ordinary conditions would not have been dreamed of. Prior to this particular period much had been said and written about *Paspalum dilatatum* and opinions were in many cases divided as to its true value. I do not think that there can be two opinions now as to its value as a good all-round fodder. At one time it looked as

though it would not stand the severe season, were the conditions to continue, but after every drop of rain there appeared to be a response that could scarcely be credited. On this farm the Paspalum was actually growing when other grasses were dying. In one paddock Cocksfoot died out, not altogether, but I should say 75 per cent. of it, and the Paspalum was growing. When the rain did come the Paspalum was 6 inches high before the other grasses had begun to move. I am perfectly satisfied that it is the most valuable grass that has been introduced into this district. The conditions suit it, and it suits the conditions. Natal Red Top was another grass that stood the dry weather well, in fact I think it can be classed next with Couch grass. In the specimen plots I had a grass that grew all the time, but it could hardly be recommended as a drought-resisting grass, as no stock were on it. The grass I refer to is Rhodes grass, introduced from South Africa by Colonel Mackay. I planted out many grass roots and seeds at the same time and obtained good results from roots, but looked upon the seed as wasted. We were generally fortunate enough to get sufficient rain to germinate any seed sown, but at a later period there was not enough to keep the plots going. *Panicum spectabile* made good growth and flourished during the driest time but at the approach of frost it was severely checked. It is a grass I would advise planting, not altogether as a drought-resisting grass, but as a general purpose grass. It could be cut and converted into ensilage along with other grasses.

Stock.—Some marked differences have been noticed in the results obtained from the cattle. On the farm there are the following breeds, viz., Ayrshire, Guernsey, Durham, Holstein, and Grade. The result of observation goes to show that during the period referred to, as one of drought, the Ayrshire gave the best result taking into consideration the climatic conditions. This breed do not appear to cut up to any great extent and keep their condition under trying circumstances. They are hardy, do not require so much feed as the larger breeds and give the best result. It would appear hardly fair to judge the Guernsey breed as we have only one cow (milking) of that breed. Nevertheless I am of opinion that from our results and results obtained elsewhere that the Guernsey will do everything that the Ayrshire can under similar conditions. Many are turning their attention to this breed and I feel safe in saying there is no need to fear but that they will bear out all that is said and written of them here and in other parts. The Durham cattle cut up a good deal and did not do as well as would be expected. Holsteins were expected to be the worst dealt with of all but it turned out the contrary, they did better than was thought. Nevertheless they are a class of cattle that require good feed and plenty of it and then the result will be satisfactory. The Grade cattle were satisfactory and up to what we are led to expect from them. combining the strong characteristics of the Ayrshire and Durham.

On the whole I think it might be said that the lessons we have learned from the drought are—(1) not to stock too heavily, and (2) the value of conserving fodder.

In addition to the above reports, and those which appeared in the issues of December and January, the following have been received, and will be published as space permits:—

ALBURY—Stock Inspector.
C. T. Napier North, Roads Superintendent.

ARMIDALE—Messrs. W. T. Everett, ,,
A. P. Hitchins, Surveyor.
H. Hogarth, ,,

BALLINA—Mr. W. A. Lee, Roads Superintendent.

BALRANALD—Mr. C. Coane, ,,

BATHURST—Mr. G. W. Orr, Surveyor.

BEGA—Mr. F. J. Morrison, Roads Superintendent.

BELLINGER—Mr. W. H. Grant ,,

Mr. Grant also forwarded reports obtained by himself from the local Progress Committees at Bucca Bucca, Never Never, Upper Orara, Upper Nambucca, North Arm, Bucca Creek, Raleigh, and Macksville.

BOMBALA—Mr. A. E. Newton, Roads Superintendent.

BOURKE—Mr. W. J. Fordyce, ,,

BOWRAL—Mr. V. B. Riley, Surveyor.

BRAIDWOOD—Mr. B. E. Shaw, Roads Superintendent.

CAMPBELLTOWN—Mr. A. Bruce Hume, *per* the Roads Superintendent.

CASINO—Mr. T. W. Spence, Roads Superintendent.

COBAR—Mr. G. M. Cummins, ,,

COONABARABRAN—Mr. G. E. Wright, ,,

COONAMBLE—Mr. P. C. Tibbitts, ,,
T. W. Medley, Inspector of Stock.

COOTAMUNDRA (Upper Murray country)—Mr. Jos. E. Gormly, Inspector of Conditional Purchases.

Mr. F. A. Murray, Roads Superintendent, with a report from Mr. W. H. Matthews, of Cootamundra.

COWRA—Mr. H. F. Osborn, Roads Superintendent.

CROOKWELL—Mr. G. R. Edwards, ,,

CUDGELLICO—Mr. T. J. S. Bloomfield, ,,

EAST MAITLAND—Mr. H. B. Mathews, Surveyor.

FORBES—Mr. Arthur Grain, Roads Superintendent.

GRAFTON—Messrs. E. Ebsworth, District Surveyor.
W. H. Walder, Surveyor.
J. V. Wikner, Roads Superintendent.

GOULBURN—Messrs. E. M. Allman, District Engineer.
G. H. Sheaffe, District Surveyor.
S. A. Steane, Surveyor.

HAY—Messrs. W. G. Donaldson, Roads Superintendent.
M. MacInnes, Rabbit Inspector.
C. R. Scrivener, Surveyor.

HILLSTON—Mr. Jas. Cadell, Inspector of Stock.

INVERELL—Mr. J. G. Fitzgerald, Roads Superintendent.

KEMPSEY—Mr. P. E. Bailey, „
KIAMA, NOWRA, MILTON—Mr. J. F. Truscott, Surveyor.
LITHGOW—Mr. J. Hope, Roads Superintendent.
MACLEAN—Mr. E. F. Crouch, „
MAITLAND—Mr. R. A. Fraser, „
MONARO—Mr. T. P. Davies, „
MOREE—Roads Superintendent.
MORUYA—Mr. H. A. Moriarty, Roads Superintendent.
MOSS VALE—Mr. Geo. F. Allman, „
MUDGEE—Messrs. W. Abernethy, Surveyor.
S. F. v. Arnheim, „
MURWILLUMBAH—Mr. W. M. C. Moore, Roads Superintendent.
MUSWELLBROOK—Mr. V. G. Morton, „
NARRANDERA—Mr. S. W. Seacham, „
NOWRA—Messrs. H. O. Rotton, District Forester.
R. Dawson, Roads Superintendent.
ORANGE—Messrs. A. W. Chapman, Surveyor.
J. M. Dixon, „
QUEANBEYAN—Mr. W. Hanlon, Roads Superintendent.
RYLSTONE—Mr. Jas. Dawson, Surveyor.
TAMWORTH—Messrs. W. S. Walker, District Surveyor.
C. W. Jenkins, Road Superintendent; including also report from Mr. J. F. Vickery, Bective Estate.
TAREE—Messrs. J. Hardiman, District Forester.
G. F. Mullen, Roads Superintendent.
TENTERFIELD—Mr. R. Nowell, „
TUMBARUMBA—Mr. R. J. Gill, „
TUMUT—Messrs. F. G. Neilley, Acting Roads Superintendent.
W. N. Nowland, Surveyor.
URANA—Mr. Geo. Silcock, „
WALGETT—Mr. O. W. Wikner, Roads Superintendent.
WILCANNIA—Mr. B. M. Millard, „
WOLLOMBI—Mr. E. F. Bridgwood, „
YASS—Mr. F. N. Oxley, „
YOUNG, GRENFELL, BURROWA—Mr. W. B. Nicholson, Roads Superintendent.

DISTRIBUTION OF THE WHEAT HARVEST.

THE accompanying map, prepared by the Government Statistician's Department, shows the distribution of the harvest of 1903-4.

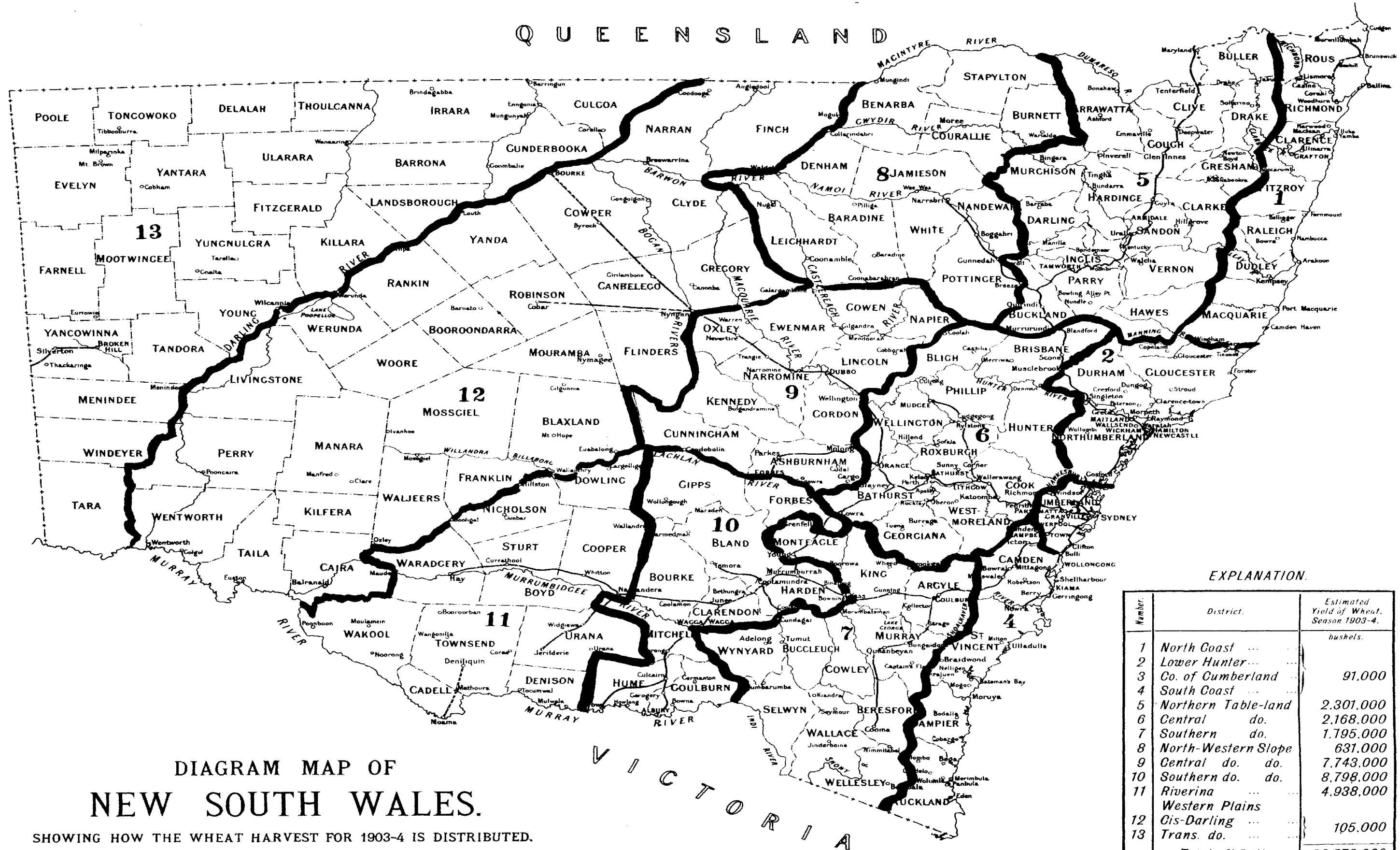

DIAGRAM MAP OF
NEW SOUTH WALES.

SHOWING HOW THE WHEAT HARVEST FOR 1903-4 IS DISTRIBUTED.

Prepared by the Government Statistician

EXPLANATION.

Number.	District.	Estimated Yield of Wheat. Season 1903-4.
		bushels.
1	North Coast ...	
2	Lower Hunter ...	
3	Co. of Cumberland	91,000
4	South Coast ...	
5	Northern Table-land	2,301,000
6	Central do.	2,168,000
7	Southern do.	1,795,000
8	North-Western Slope	631,000
9	Central do. do.	7,743,000
10	Southern do. do.	8,798,000
11	Riverina ...	4,938,000
	Western Plains	
12	Cis-Darling ...	105,000
13	Trans. do. ...	
	Total N.S.W.	28,570,000

Universal Nomenclature for Wheat.

(Continued from p. 549, 1903.)

By N. A. COBB.

The Volume, Microscopic Structure, and Strength of the Aleuron Layer, and some Results flowing therefrom.

TURNING from the comparative structure of the aleuron layer to its amount and the relation of its structure to the production of flour, we come to a subject of considerable interest and one that does not seem to be very well understood. Not knowing of any attempts to estimate the volume of the aleuron in ordinary wheat grains, I will first give the results of some rough calculations made upon Australian grains in the course of my examinations of this layer.

Space occupied by the Aleuron in the Wheat Grain.

An examination of Figs. 11 to 63 will show what a wide range of choice was presented by the material at hand for this examination. Two varieties were chosen, one, White Velvet, a bread wheat, the other, Poland, a hard wheat. The first of these has light-coloured roundish grains of medium size, the other, very elongated dark-coloured grains of the very largest size. In one the grain is almost invariably opaque and floury, while in the other it is almost invariably translucent. One produces a typical flour for the manufacture of bread, while the other will produce a semolina for the manufacture of macaroni. One gives a moderate return of gluten in the ordinary chemical examination of its flour, while the other gives a high return. In other ways there is a strong contrast in the properties of the grains of the two varieties.

A good idea of the appearance of these two grains is given in the illustrations on p. 164, while their relation to other well-known wheat varieties may be seen in the classified figures of some fifty kinds given on pp. 161 to 163.

While the examination of a larger number of varieties would have been desirable, suitable opportunity to extend the inquiry did not present itself. It will be noted that the difference exhibited by the two varieties is a marked one, as might have been anticipated from the surface examinations of the aleuron layer, explained on an earlier page, where, as the result of the average of a three-years examination, these two varieties stand at 2 and 37 in a list numbering 55.

Tabular and analytic arrangement of the varieties of Wheat the grains of which are illustrated in Figs. 11-63.

SOFT WHEATS (*Triticum sativum*).

- Ears not bearded
  - Ears velvety
    - Ears white ... 1. White Velvet
    - Ears red ... 2. Velvet Pearl
  - Ears smooth
    - Ears reddish ...
      - Grain yellowish
        - Early, plump grained ... 3. Allora Spring
        - Mid-season, elongated grained ... 4. Marshall's 3; 5. Marshall's 8; 6. Robin's R.R.; 7. Ward's Prolific
      - Grain reddish ... 8. Sicilian Square-headed Red
    - Ears white, yellowish, or rosy
      - Straw purple ...
        - Ripens early ... 9. Steinwedel
        - Ripens mid-season
          - Ears clubbed ... 10. Rattling Jack
          - Ears uniform ... 11. Rattling Tom; 12. Farmer's Friend; 13. Red Straw; 14. Fillbag; 15. Hudson's E'rly P'rpl' Str'w; 16. Steer's Early Purple Straw
      - Straw not purple
        - Ripens early ... 17. Early Para; 18. King's Jubilee
        - Ripens mid-season
          - Ears uniform ...
            - Chaff rosy ... 19. Oakshott's Champion; 20. Battlefield
            - Chaff white with salmon streaks ... 21. White Lammas
          - Ears tapering
            - Grain yellowish
              - Ears open
                - Chaff hooked ... 22. Zealand
                - Chaff not hooked
                  - Ears yellowish ... 23. White Naples; 24. Leak's R.R.; 25. Australian Talavera; 26. Frampton; 27. White Lammas
                  - Ears white ... 28. White Essex
              - Ears very open ... 29. Talavera de Bellevue
            - Grain ruddy ... 30. Dallas
        - Ripens late
          - Grain large ... 31. Golden Drop
          - Grain small and flat
            - Ears not clubbed
              - Grain not red
                - Ears uniform ... 32. Pringle's Defiance; 33. Blount's Lambrigg; 34. Thomas' R.R.
                - Ears tapering ... 35. Improved Fife
              - Grain red ... 36. White Fife; 37. Fultz; 38. Saskatchewan Fife
            - Ears clubbed ... 39. Hedgerow; 40. Little Club
- Ears bearded ...
  - Ears whitish
    - Grain whitish or yellow
      - Plants tall ... 41. Early Baart; 42. French Early B'rded; 43. Dutoits
      - Plants short ... 44. Canning Downs; 45. Gore's Indian
    - Grain red ... 46. Darblay's Hungarian
  - Ears reddish
    - Ears slender ... 47. Anglo-Australian; 48. Rieti
    - Ears clubbed ... 49. Bearded Hérisson

POULARD WHEATS (*Triticum turgidum*)

- Ears multiple ... 50. Mummy
- Ears simple ... 51. Algerian

DURUM WHEATS (*Triticum durum and polonicum*).

- Ears with ordinary chaff ...
  - Chaff yellow or light brown ... 52. Belotourka
  - Chaff black or dark grey ... 53. Medeah
- Ears with gigantic chaff ... 54. Poland.

Fig. 11.—White Velvet.

Fig. 12.—Velvet Pearl.

Fig. 13.—Allora Spring.

Fig. 14.—Marshall's No. 3.

Fig. 15.—Marshall's No. 8.

Fig. 16.—Robin's R.R.

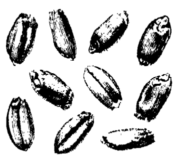

Fig. 17.—Ward's Prolific.

Fig. 18.—Sicilian Square-headed Red.

Fig. 19.—Steinwedel.

Fig. 20.—Rattling Jack.

Fig. 21.—Rattling Tom.

Fig. 22.—Farmer's Friend.

Fig. 23.—Red Straw.

Fig. 24.—Fillbag.

Fig. 25.—Hudson's Early Purple Straw.

Fig. 26.—Steer's Early Purple Straw.

Fig. 27.—Early Para.

Fig. 28.—King's Jubilee.

Figs. 11 to 63. Grain of the series of wheat varieties shown in the table on the previous page.—The grains are arranged in the order given in the analytical table, and are shown natural size, and, so far as is possible with black and white, in their true tints. The relative form and size of the grains of the various varieties is well brought out. The illustrations are prepared from carefully selected average-sized grains.

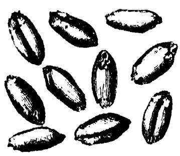

Fig. 29.—Oakshott's Champion.

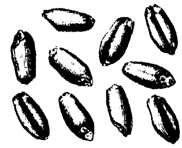

Fig. 30.—Battlefield.

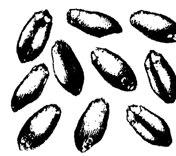

Fig. 31.—White Lammas.

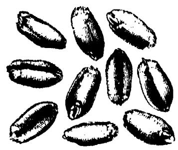

Fig. 32.—Zealand.

Fig. 33.—White Naples.

Fig. 34.—Leak's R.R.

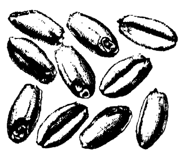

Fig. 35.—Australian Talavera.

Fig. 36. Frampton.

Fig. 37.—White Essex.

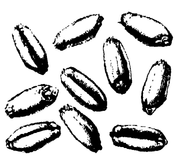

Fig. 38.—Talavera de Bellevue.

Fig. 39.—Dallas.

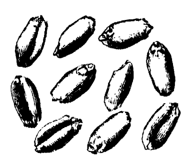

Fig. 40.—Golden Drop.

Fig. 41.—Pringle's Defiance

Fig. 42.—Blount's Lambrigg.

Fig. 43.—Thomas' R.R.

Fig. 44.—Improved Fife.

Fig. 45.—White Fife.

Fig. 46.—Fultz.

Figs. 11 to 63. Grain of the series of wheat varieties shown in the table on page 160. —The grains are arranged in the order given in the analytical table, and are shown natural size, and so far as s possible with black and white, in their true tints. The relative form and size of the grains of the various varieties is well brought out. The illustrations are prepared from carefully selected average-sized grains.

Fig. 47.—Saskatchewan Fife.

Fig. 48.—Hedgerow.

Fig. 49.—Little Club.

Fig. 50.—Early Baart.

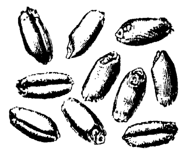

Fig. 51.—Dutoits.

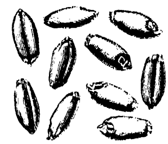

Fig. 52.—Stockton Defiance.

Fig. 53.—Canning Downs.

Fig. 54.—Gore's Indian.

Fig. 55.—Darblay's Hungarian.

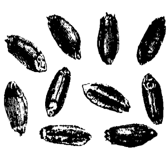

Fig. 56.—Anglo-Australian.

Fig. 57.—Rieti.

Fig. 58. Bearded Hérisson.

Fig. 59.—Mummy.

Fig. 60.—Algerian.

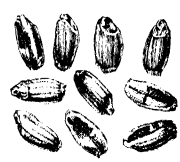

Fig. 61.—Belotourka.

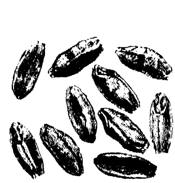

Fig. 62.—Medeah.

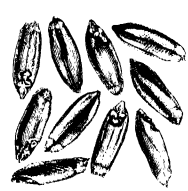

Fig. 63.—Poland.

Figs. 11 to 63. Grain of the series of wheat varieties shown in the table on page 160.—The grains are arranged in the order given in the analytical table, and are shown natural size, and, so far as is possible with black and white, in their true tints. The relative form and size of the grains of the various varieties is well brought out. The illustrations are prepared from carefully selected average-sized grains.

The Aleuron in White Velvet Wheat.

Twenty dry grains from a large-grained sample of White Velvet wheat were calipered with the following results:—

White Velvet.	Thickness in m.m.	Width in m.m.	Length in m.m.	White Velvet.	Thickness in m.m.	Width in m.m.	Length in m.m.
1	2·6	3·0	5·4	13	2·8	3·0	5·6
2	2·8	3·1	5·4	14	2·7	3·1	5·9
3	2·6	2·8	5·9	15	2·6	2·7	5·4
4	2·7	2·8	5·3	16	2·8	3·1	5·6
5	2·7	3·0	6·0	17	2·9	3·2	5·6
6	2·8	3·2	5·9	18	2·8	3·3	5·7
7	2·7	2·8	5·7	19	2·8	2·9	5·3
8	2·8	3·1	6 0	20	2·8	3·2	5·4
9	2·9	3·0	5·9				
10	2·7	2·8	5·2		55·2	830·2	112·8
11	2·8	3·0	6·2				
12	2·9	3·1	5·4	Average ...	2·76	3·01	5·64

Grain number 13, having nearly the average dimensions, was selected to be soaked and sectioned and microscopically examined. The sections were made of equal thickness and numbered in all thirty-eight, exclusive of about three near the brush end of the grain, which

White Velvet.

Poland.

Fig. 64.—Natural size illustrations of the grains of the wheat varieties, White Velvet and Poland, the two varieties used in the calculation of the approximate volume of the aleuron in the wheat grain.

could not be cut owing to the imbedding being simply in elder pith. Section number 23, counting from the base of the grain, was drawn and measured, the surface of the section showing 8·8 per cent. of its area occupied by the outer layers of the bran, 6·2 per cent. of its area occupied by the aleuron layer, and the remainder by flour cells. These figures would apparently represent the relative volumes occupied by these portions of the grain, judging from the cross-section, but in considering the aleuron we must deduct the volume of the massive cell-walls that contain it, these having been included in the above measurement of area. Moreover, it is necessary to allow not only for the volume of these walls as they present themselves in a transverse section of the grain but also for those portions of the walls that are parallel to the plane of the section and hence do not appear. On making drawings of the walls of various aleuron cells in various positions it was found that it would be necessary to deduct as follows from the above figures:—from 6·2 per cent. representing the entire aleuron layer cell walls included, deduct 34·2 per cent. for walls cut

transversely, and an additional 8·7 per cent. for walls parallel to the section. This leaves 3·72 per cent. as the volume of the section occupied by the aleuron grains, or rather by the contents of the aleuron cells.

Of course this method of arriving at the volume of the aleuron is a rough one. I think it quite safe to say that the result obtained is greater than the actual volume, *i.e.*, supposing we apply the above figure to the entire grain—for it will be remembered that the area over the embryo is almost destitute of aleuron, and that elsewhere in the grain the aleuron layer is thinner than at the part measured. This was verified in the present case by taking the longitudinal section of another similar grain. The volume of the nuclei of the aleuron cells is here included with that of the aleuron. It would seem, therefore, to be perfectly safe to say that the volume occupied by the aleuron in the grain examined did not exceed 3·72 per cent. of the total volume of the grain.

The particular grain examined was taken from a sample that yielded flour containing 12 per cent. gluten. Taking the flour as 70 per cent. of the grain, it is evident that at least 8·4 per cent. of the grain was gluten.

Subsidence experiments showed that the various cell-components of the wheat grain do not vary widely in specific gravity. They subside in water at no very unequal rates, and from this it follows that we may assume something that might be also assumed on other and quite independent grounds, namely, that the specific gravities of the various cell-components of the wheat grain are not widely different from each other.

The Aleuron in Poland Wheat.

Following a process similar to that described in the case of White Velvet, a selected average-sized grain was soaked in 33 per cent. alcohol for thirty-six hours, and was then cut transversely into eighty slices. The volume occupied by the outer layers of the bran, the aleuron, and the flour-cells, respectively, was taken on several sections, beginning near the base of the grain.

No. of Section.	Distance from base of Grain, in inches.	Vol. of the outer layers of the Bran.	Vol. of Aleuron layer.	Vol. of Flour-cells.
		per cent.	per cent.	per cent.
13	·032	24·0	7·0	69·0
20	·062	15·6	5·9	78·5
31	·110	7·9	5·5	86·6
41	·150	7·7	6·9	85·4
52	·200	8·6	6·4	85·0
63	·250	10·5	6·8	82·7
72	·300	11·3	8·9	80·8

From this it is evident that (inasmuch as up to number 31 the sections are small, and represent only a small part of the grain) the aleuron layer in the greater part of the grain occupies from 7 per cent. to 9 per cent. of the volume, or on an average, and roughly speaking, 8 per cent.

Here again this volume of the aleuron layer must be reduced by the amount of the volume of the thick walls of the aleuron cells in order to give the real volume occupied by the aleuron itself. In the section this appears to be about 15 per cent. of the whole volume of the aleuron layer; but this does not allow for the walls parallel to the optical plane, for which half as much again would have to be allowed, or, say, in all (15 plus 7·5) 22·5 per cent. Subtracting this amount leaves the volume of the aleuron at 6·2 per cent. In all probability this 6·2 per cent. of the volume of the soaked grain is all that can be allowed to the contents of the aleuron cells.

This result was checked by the examination of two sections of the dry grain, examined by reflected light.

Section.	Vol. of the outer layers of the Bran.	Vol. of Aleuron layer.	Vol. of Flour Cells.
	per cent.	per cent.	per cent.
One-fourth way from base.. ...	7·2	7·9	84·9
One-half way from base	5·3	5·1	89·6

This gave no reason to doubt that the volume of aleuron in the dry grain might be roughly judged from the volume in the soaked grain.

It might be thought that the grains would vary in structure, and hence three separate grains were examined at corresponding points.

Three average grains of White Velvet gave as the percentage of aleuron layer at corresponding points 6·58 per cent., 6·62 per cent., and 6·48 per cent.—average, 6·56 per cent.—the gross variation being ·14 when that average was obtained as the result of three examinations.

This shows that the grains of an ordinary sample of a variety are in all probability pretty uniform in structure,—sufficiently so to warrant the conclusions arrived at.

Let us pass for a moment from the absolute amount of aleuron in the wheat grain to the amount of this substance that may find its way into ordinary flour. It would be difficult by any method yet devised to determine the precise proportion supplied to any given sample of ordinary flour from the aleuron of the wheat-grains from which it was made; but it is not difficult to estimate approximately the amount that may be, or is likely to be, so derived.

Aleuron Layer in Clean Bran from the Mill.

When what is known to the miller as "clean bran" is examined under the microscope, it is found that the aleuron layer is nearly intact in most instances. The following is a typical case for Australian bran. I was supplied a sample of clean bran from Australian flour made in Sydney from Australian wheat. On being soaked it was found that the aleuron layer was intact in nearly all parts. It is very

easy to tell when the cells of the aleuron layer have been mutilated, for in that case the contents of these cells escape more or less into the fluid in which they are examined; and this leaves the cells more transparent because of their emptiness. This appearance is very striking, because the matter contained in these cells is usually rather opaque when examined in fluid.

It is not uncommon to hear millers who come at this matter from the point of view of the mill alone, and have little microscopic knowledge with which to fortify themselves, speak of cleaning the bran until some of the "gluten layer" (meaning thereby the aleuron layer, which, however, contains no gluten) is worked off into the flour. I very much doubt if this is ever the case to any considerable extent in Australian milling. It seems to be thought that some of this aleuron layer can be removed without breaking up the bran. This, I think, is not so, for the strength of the bran is due largely to the tough character of the aleuron layer, which is by far the toughest layer of the bran. If this layer were interfered with the bran would be completely mutilated. It constitutes about half of the volume of the dry bran, and its cell walls are by far the strongest and most massive to be found in the bran.

I have heard it said that the inner ends of these cells (aleuron cells) are worked off into the flour. I have seen no evidence of this. Bran from the mill, even the cleanest of it, when examined microscopically, shows the aleuron cells for the most part intact If the bran be soaked and cross-sectioned it is found that the walls of the aleuron cells have not been broken on the side next the flour cells. The usual appearance is an intact aleuron layer with flour cells attached to it, together with a considerable amount of starch, somewhat as previously shown in the coloured plate. This evidence from cross-sections of bran is of a most decisive character,—the aleuron cells are unbroken for the most part, and their contents remain *in situ*.

It appears, therefore, that the only chance for the contents of the aleuron cells to get into the flour is from such cells as become broken when the bran is broken to pieces by the rollers of the mill. Of course, where the bran is broken across, some of these cells may be ruptured and their contents in this way scattered. The quantity that thus finds its way into the flour must be very small.

The average sized flakes of bran, derived from such wheat as I examined, had a contour of about 10 millimetres. This means that the length of all the cracks produced in breaking the grain would be one-half of this contour multiplied by the number of such pieces derived from a single grain, namely, about a dozen. Of course, twelve such pieces would present 120 millimetres of perimeter, but as each crack must have two sides, it follows, as said above, that the actual length of crack is only half the length of the total of the perimeters, or 60 millimetres, or 60,000 micromillimetres. The average diameter of the aleuron cell of such a grain is about 40 micromillimetres, from which it follows that the cracks made in milling the grain would traverse about 1,500 aleuron cells.

Dividing the area of the grain, about 72 square millimetres, by the area of one aleuron cell, about ·0016 square millimetres, we have 45,000 as the approximate number of aleuron cells to the grain of wheat, supposing them to be equally distributed over the grain, which is not quite true, as we shall soon see.

Assuming it to be true for the present, and noting that the number of aleuron cells along the cracks (1,500) is 3⅓ per cent. of 45,000, we arrive at the conclusion that if every aleuron cell traversed by cracks in the bran were broken and its entire contents handed on into the flour, then 3⅓ per cent. of these cells would be so broken and made to contribute to the flour.

It will be remembered that measurements and calculations showed the volume of the aleuron in a soft wheat to constitute not more than about 4 per cent. of the volume of the grain.

If only 3·3 per cent. of the aleuron cells are broken so as to allow their contents to pass into the flour, then only ·04 x ·033 or ·00122 of the volume of the grain would pass in this manner into the flour. Allowing that 70 per cent. of the grain is converted into flour, then ·0017 of the flour might be derived from the aleuron layer, or less than two-tenths of 1 per cent.

In the course of this calculation we have made various assumptions, which it will be better to now explain more fully.

It is assumed that all the aleuron cells along the track of the cracks in the bran made in milling are broken open in the process. This is not so. The major portion of them may be so broken, but not by any means all of them. It is not unusual to find edges of bran that have nearly all the aleuron cells intact. This comes about from the tendency of the aleuron cells to split apart without bursting. This tendency is easily tested by preparing a layer of the aleuron according to the methods described in previous pages, and then tearing it with needles and examining under a microscope, when it will be found that most of the cells have remained intact. This pulling apart is not by any means so perfect when it is accomplished by the rollers of the mill, still the tendency comes into play, and the result is that a considerable number of cells remain whole, and in consequence do not allow their contents to pass out into the flour.

When the cells are broken they are often so imperfectly broken as to retain a large portion of their contents. These two facts, viz., that not all the cells are broken, and that of those broken only a portion of their contents get into the flour, would diminish the result of the foregoing calculation by a large percentage.

We have assumed in the calculation that the aleuron layer is uniform over the whole grain. This is not so, there being a considerable area in the vicinity of the embryo where it is much thinner, and apparently almost wanting. This would further diminish the result of the calculation, and that too by a considerable amount.

As a result of these rough calculations, it is my belief that in many cases the volume of the flour derived from the aleuron layer does not equal one-tenth of 1 per cent.

Fig. 65.—Method of removing the flour from the interior of wheat grains by hand. An ordinary steel hand-vise, A, is clamped to a wooden block B. The steel hand-vise is made to grip the rubber jawed clamp C (shown also in Fig. 66). After the jaws of the rubber clamp have been made to grip the grain, as described at Fig. 66, p. 171, the tongue of rubber projecting underneath (*b*, Fig. 66) is used as a hold for the jaws of the steel vise.

The removal of the flour has to be accomplished with the aid of a good magnifying glass such as that shown at D D.

The first scrapings are placed on the black disc numbered 1, and the successive scrapings are placed in order on the discs as numbered. In the case illustrated the middle of the "core" (arbitrarily so-called) having been reached at numbers 8–9, the order of the black discs is reversed, so that the final scraping will be located opposite the first disc. In the present case the sixteenth and final disc comes opposite the first.

The allocation of the flour constituting the five artificial zones is now accomplished as follows:—

1. The scraped-out bran, carrying one zone, is placed in the pair of watch glasses numbered 5.

2. The flour on the four black discs at the reader's right is placed in the watch glasses numbered 4.

3. The flour on the next four black discs goes to watch glasses numbered 3.

4. The flour on the next four black discs goes to the watch glasses 2.

5. The flour (core flour) on the four left-hand discs goes to watch glasses numbered 1.

These operations are repeated with each half grain until sufficient flour has been accumulated.

Distribution of Gluten in the ripe endosperm of typical Australian wheat.

We turn next to an examination of the structure of the endosperm of the wheat grain, the portion made up of flour-cells only.

The flour cells of some Lammas grains were removed in three parts—

1. What I will term the core, *i.e.*, an "axial" portion in each half of the grain, having the form of a somewhat semi-cylindrical surface. Its precise form is not easily described, but will be readily understood later on by referring to Fig. 67.
2. A zone outside this first "axial" portion.
3. An outermost zone bordering on the aleuron layer.

The flour was removed from each of these zones by hand from each grain successively with almost mathematical precision.

The flour from the three zones was examined separately, with the following results:—

1. Core or inmost zone ...	Starch, 93·3 % ...	Gluten, 6·7 %.
2. Second or middle zone ...	„ 90· % ...	„ 10· %.
3. Outermost zone	„ 83·6 % ...	„ 16·4 %.

This seemed to show a gradual increase in gluten from core to exterior.

The experience gained in this first examination of course gave hints for improvement in the methods, and these improvements were adopted in the examination now to be described.

In this instance a sample of the Purple Straw type was used, and the grains selected for examination were secured by sieving out some grains of the 3·25 grade, and selecting from these some plump and symmetrical individuals, the idea being to secure large plump grains that, on account of their perfect condition and symmetrical shape, would undergo the scraping-out process to the best advantage. The removal of the flour was accomplished with great care and skill by Mr. E. M. Grosse.

The selected grains were soaked, one by one, in water for about one minute, in order to loosen the outer layer of cells, and this outer layer was then immediately removed with the aid of a magnifying glass. All but a small portion in the crease of the grain could thus be easily peeled off, and this residue was removed by a subsequent operation. This preparation of the grain removed all traces of dirt that might have been present on the surface of the grain, and had the further advantage that the brush of the grain was completely removed, so that it could give no trouble during the removal and determination of the flour left attached to the bran after the final scraping. On an earlier page I have called attention to the tendency of the hairs of the brush to cause difficulty in this manner.

After the outer skin had been removed in the manner described, the grains were allowed to dry in the atmosphere for two weeks so as to attain a normal condition. They were then sawn in halves longitudinally with a fine jeweller's saw and very slowly and carefully scraped out with a fine and sharp dentist's scraper.

The position of the saw-cut, as well as its size, are illustrated to scale in Fig. 67. It will be seen that the cut passed through the crease of the grain, and that the width of the saw was such as to remove that portion of the outer skin still remaining in the crease, together with some of the inner skin and some of the aleuron layer. There were invariably some very small fragments of the outer skin left intact by this process, and these were carefully removed under a magnifying glass before starting on the production of the five zones of flour determined upon. See Fig. 67.

It is next necessary to describe the methods adopted in order to establish the five flour zones with accuracy. To a certain extent the selection of the flour during one portion of the operation is a matter of judgment only. I refer to the part immediately surrounding the crease (Fig. 67) where, in the process of scraping, one comes first to the outer of the five arbitrary zones of the inner endosperm. Here these artificial zones come in the reverse order from that in which they are taken during the greater portion of the scraping process. This is not a serious difficulty; but the result in this portion of the operations is not quite so reliable as in the remaining and far greater part of the process.

In order to hold the grain during the tedious process of scraping, Mr. Grosse invented an ingenious clamp, which is illustrated in Fig. 66. Generally speaking, the process of removing the flour

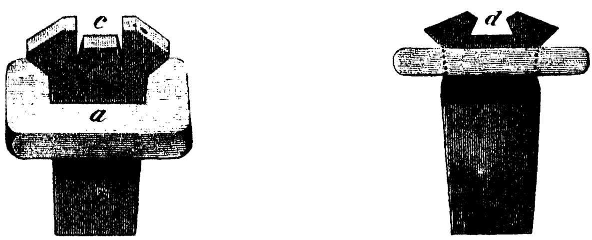

Fig. 66.—Clamp with rubber jaws devised to hold grains of wheat while undergoing the scraping process necessary to the accurate removal of the flour-cells from the series of arbitrary "concentric" zones.

An ordinary rubber eraser is carved into the form shown at *c*. A small block of wood, *a*, is pierced with an oblong hole to fit the carved piece of rubber. When the carved eraser is placed in the block of wood and pulled into place as shown at *d*, the jaws of rubber approach each other and grip the grain in such a manner as to hold it firmly, yet without risk of injury.

consisted in scraping loose from the whole inner surface of the half grain a minute amount of the flour and dumping it on a plate of glass in a tiny pile. The result of each scraping was deposited on a glass disc in a tiny pile by itself, and the piles were arranged in a line. When the operation was completed and the grain scraped out to the desired extent the piles were divided into four equal groups, and these were reckoned as belonging to the four inner arbitrary "concentric" zones. The flour still adhering to the bran constituted the fifth zone. The fifth zone was left attached to the bran, and was completely removed by the maceration method previously described. Of course, as the scraping began near the crease, the

tiny piles for this part of the operations had to be taken in the reverse order. This method, I think it must be conceded, gave rise to the establishment, with greater precision than has been before attained, of a number of equal artificial flour zones in the wheat grain of which the innermost may be called the core zone—or No. 1 zone, to give it a perfectly non-committal name—and four others "concentric" with it, each a little thinner than its predecessor in the order of their numbering. These arbitrary zones are accurately illustrated to scale

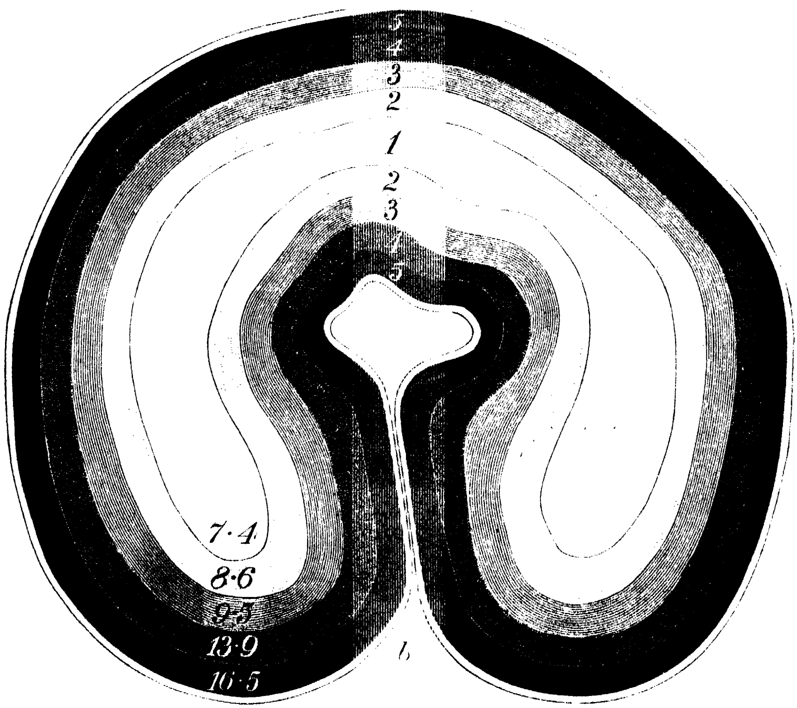

Fig. 67.—Diagram of a cross section of a grain of wheat of the Purple Straw type, showing the location of the five arbitrary "concentric" zones or layers of flour removed by hand. The "core" is shown white, and each successive zone is shown in a darker shade, the outermost zone being represented black. Outside the zones the bran is represented as a narrow white layer. The five zones are numbered 1, 2, 3, 4, 5, and are successively thinner toward the outside of the grain. The percentages of gluten found in the flour are marked on each zone. Zone 1, 7·4 per cent.; zone 2, 8·6 per cent.; zone 3, 9·5 per cent.; zone 4, 13·9 per cent.; zone 5, 16·5 per cent. The saw-cut mentioned in the text is represented by the band *ab*. This saw-cut divided the grain longitudinally into two halves, and removed an amount of matter corresponding to the width of the cut as shown. This diagram is drawn to scale.

It should be understood that there are no such layers as 1, 2, 3, 4, and 5 in actual existence in the wheat grain among the flour-cells, which are all of similar origin. The diagram merely represents with accuracy the regions from which the samples of flour were derived.

in Fig. 67, where it will be seen that the inner No. 1 zone is the widest, and the succeeding zones, illustrated in successively darker shades, become thinner and thinner. It is, of course, unnecessary to add that no such sharply defined zones (or anything corresponding to them) actually exist among the flour cells of the grain of wheat. These zones as here described and figured are perfectly arbitrary.

It was, of course, a matter of judgment how much flour to leave attached to the bran in order to have zone No. 5 equal in volume to the others. The following figures will serve to illustrate the accuracy attained :—

Weight of flour from zone No.	1 ...	·1308
,, ,,	2 ...	·1254
,, ,,	3 ...	·1315
,, ,,	4 ...	·1267
,, ,,	5 ...	·1114

From which it will be seen that the zones were very well laid out.

An examination of the flour from these five arbitrary zones resulted in showing that—

Zone No. 1	contained	7·4	per cent. by weight	of gluten
,, 2	,,	8·6	,,	,,
,, 3	,,	9·5	,,	,,
,, 4	,,	13·9	,,	,,
,, 5	,,	16·5	,,	,,

These results confirm the statements of a few previous investigators, that as we pass from the inner part of the wheat grain to the outside there is in the flour cells a gradual increase in the amount of the substances returned by the chemist as gluten.

It seems to me probable that the various partial products produced in modern milling, if used as a basis for reasoning on the distribution of the gluten in the wheat grain, are rather unsatisfactory or even misleading. The following very simple experiment will show one of the difficulties of reasoning from the products of the mill :—

Separation of Starch and Gluten in the process of Sieving.

Two samples of flour were obtained by sieving the core flour of a Purple Straw wheat. The flour consisted of matter removed with a dentist's scraper, and would correspond to the inner or the two inner layers of the illustration showing five equal-volume layers (Fig. 67)—in other words, was a sample of flour accurately removed from the core of the grains.

The sieve used was one of 112 meshes to the inch—a fine silk sieve. An effort was made to sift the sample of flour into two equal parts, one of which had passed through the sieve while the other had remained on the sieve. This result was attained approximately, the part that remained on the sieve being one-fourth as much again by weight.

Of course, the two samples differed materially in the size of their component granules, that which had passed through the sieve being the finer,—being, in fact, composed largely of grains of starch pure and simple. The relative appearance of the two samples is shown in the two figures on the following page.

Examination gave the following results :—

	Starch, per cent.	Gluten, per cent.
Flour passed through the sieve ...	96·4 ...	3·6
"Flour" remaining on the sieve ...	92·9 ...	7·1

In other words, the sample that passed through the sieve contained about half as much gluten as the other.

From this it appears that the tendency of the starch grains during the process of making flour is to fly loose and to pass in a preponderating quantity into the earlier siftings. This appears to me to be in

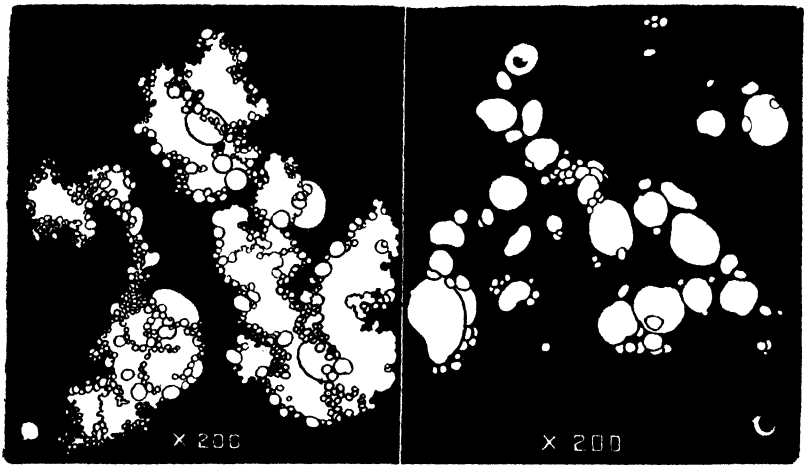

Fig. 68.—Comparative size of two samples of flour, both derived from the core of the wheat grain, one of which, that on the right, has passed through a fine sieve, and the other, that on the left, has remained on the same sieve. The portion that has passed through the sieve, consisting largely of starch grains, pure and simple, is composed of finer particles than that which remained on the sieve. Examination proved the sample illustrated on the left, the part which remained on the sieve, to contain about twice as much gluten as the other.

accord with the tough nature of the gluten and its distribution in the flour cells, for, as I have previously intimated, and shall next proceed to explain, the starch granules in each flour-cell of the ripe grain are held enmeshed in the dry and tough elaborate network of protoplasmic matter, which, when soaked, assembled, and weighed by the chemist, is entered in his returns under the name of gluten.

I am inclined to think that in the present case the flour having been to a certain extent cut or scraped away from the grain would perhaps be of a slightly different texture from that produced by the pressure of the mill. This point can be easily tested by means of the illustrations.

The gluten assembled from the siftings was more difficult to collect than that from the part that remained on the sieve.

(*To be continued.*)

Sheep for Codlin Moth.

Mr. W. Farrer, Wheat Experimentalist to the Department, states that, five or six years ago, Codlin Moth was abundant in his orchard at Tharwa. Sheep were turned in early in the season and left there as long as there were any apples in the orchard, and they eat windfalls as fast as they fell. This was done for two (2) consecutive seasons, and since then, as far as Mr. Farrer can see, there has not been an apple with Codlin Moth in it.

Hawkesbury Agricultural College and Experimental Farm.

VARIETIES OF OATS AT THE HAWKESBURY AGRICULTURAL COLLEGE, 1903.

GEO. L. SUTTON, EXPERIMENTALIST.

As many varieties as were procurable in the State were obtained and planted with the object of determining the most suitable varieties

(*a*) For Hay.
(*b*) For Ensilage.

The season, owing to the liberal rainfall, was exceptionally favourable for the growth of this crop, and in consequence some heavy yields were obtained. On the other hand, owing to the same cause, i.e., the moist season, rust was very prevalent. A specially favourable opportunity was therefore available for noting the rust-resisting qualities of the different varieties growing.

Owing to the number of varieties tried, and the small area at our disposal for the trial of them, the plots devoted to each variety were necessarily small. The varieties were planted rather thickly in drills

Oats Plots showing tangled growth.

1½ feet apart, by means of the Planet Jr. Hand Seed Drill. Each variety occupied a plot which was 2 drills wide and 3 chains long. No manure or fertilizer was applied to this crop, as the previous crop —onions—had received a liberal dressing of stable manure.

Following the plan adopted with other crops grown for comparison, a well-known variety of merit, Algerian, was planted adjacent to each of the other varieties, so that each could be compared with this variety, Algerian, similarly situated to all, and then with each other.

It was intended to harvest each variety as it flowered, but this plan had to be abandoned, as, owing to the excessive rain and rank growth of most of the varieties, nearly all of them became badly "laid" before they came into ear. It was feared that if they were allowed to remain,

Argentine.

Algerian.

and the moist weather continued, they would rot on the ground rather than mature. It was therefore necessary to harvest them at this stage. With the exception of "Argentine," which was the earliest variety grown this season, and which was harvested on October 14th, the whole of the varieties were harvested on October 29th and 30th. The Algerian at this time was well out in flower.

In order to estimate the yield per acre, a portion of each plot 2 chains long, and situated in the centre of the plot, was weighed as harvested. The harvesting was done as carefully as possible by hand, but was rendered somewhat difficult by the tangle of varieties.

The results are as follows :—

OATS at the Hawkesbury Agricultural College, 1903.—Tabulated result of trials.—Planted 30th May, 1903.

Plot No.	Variety.	Seed obtained from.	Yield per portion weighed.	Computed yield per acre.	Date harvested.	Remarks.
			ct. qr. lb.	t. ct. qr. lb.	1903.	
1	Algerian	Yates & Co.	1 3 16	10 8 0 24	29 Oct. ..	Not badly laid ; slightly rusty.
2	Peerless White Bonanza	Experimental Farm, Bathurst	3 2 21	20 5 1 14	29 ,, ..	Very coarse ; nearly all laid ; very rusty ; breaking into ear.
3	White Bonanza	,, ,, ,, ..	2 3 8	15 10 1 12	29 ,, ..	,, ,, ,, ,,
4	Algerian	Yates & Co.	1 3 20	10 12 0 16	29 ,, ..	Badly laid ; slightly rusty.
5	Golden Giant	Experimental Farm, Bathurst	2 1 25	13 12 0 6	28 ,, ..	Very coarse ; nearly all laid ; very rusty ; not in ear.
6	Carter's Royal Cluster..	,, ,, ,, ..	2 2 24	14 8 2 8	29 ,, ..	,, ,, ,, ,,
7	Algerian	Yates & Co.	1 3 26	10 18 0 4	29 ,, ..	All laid ; slightly rusty.
8	Hopetoun	Experimental Farm, Bathurst	2 3 21	16 3 0 14	29 ,, ..	Very coarse ; all laid ; very rusty ; not in ear.
9	Pioneer	,, ,, ,, ..	2 3 25	16 7 0 6	29 ,, ..	,, ,, ,, ,,
10	Algerian	Yates & Co.	2 0 8	11 7 3 12	29 ,, ..	Rather coarse ; all laid ; slightly rusty.
11	American Banner ..	Experimental Farm, Bathurst	3 0 25	17 14 2 6	29 ,, ..	Very rank and coarse ; all laid ; very rusty ; just coming into ear.
12	Argentine	South Africa	1 1 26	8 3 0 4	14 ,, ..	The earliest variety ; in ear, 28/9/03 ; only very slightly rusty, and fine in straw ; only a small portion laid.
13	Algerian	Yates & Co.	2 0 12	11 11 3 4	29 ,, ..	Not badly laid ; slightly rusty.
14	Wide-awake	Experimental Farm, Bathurst	2 0 11	11 10 3 6	29 ,, ..	Rather rank, coarse, and rusty, but not badly laid ; flag discoloured ; breaking into ear.
15	Clydesdale	,, ,, ,, ..	2 1 2	12 9 1 24	29 ,, ..	Very rusty, coarse, and rank ; not badly laid, breaking into ear.
16	Algerian	Yates & Co.	2 1 20	13 7 0 16	29 ,, ..	Slightly rusty and somewhat coarse ; portions laid.
17	Dun	Experimental Farm, Bathurst	1 2 3	8 7 3 22	29 ,, ..	Coarse growth : badly laid and very rusty ; not in ear.
18	,, ...	Foster & Sons	1 2 17	9 1 2 22	29 ,, ..	,, ,, ,, just coming into ear.
19	Algerian	Yates & Co.	1 3 18	10 10 0 20	29 ,, ..	Very slight rust ; only slightly laid.
20	Russian	South Africa	3 1 22	18 19 0 12	29 ,, ..	All laid ; rank, coarse, and very rusty ; out in ear.
21	White Tartarian ..	Experimental Farm, Bathurst	2 1 27	13 14 0 2	29 ,, ..	Nearly all laid ; rank and coarse ; very rusty ; not in ear.
22	Algerian	Yates & Co.	1 3 20	10 12 0 16	29 ,, ..	Badly laid ; inclined to be coarse ; slightly rusty.
23	Black Winter	Experimental Farm, Bathurst	2 0 19	11 18 2 18	29 ,, ..	All lying down ; rank, coarse, and very rusty ; not in ear ; commencing to rot.
24	Red Rust Proof	,, ,, ,, ..	1 2 6	8 10 3 16	29 ,, ..	Rather coarse, but very little rust ; slightly laid ; in flower.
25	Algerian	Yates & Co.	2 0 22	12 11 2 12	29 ,, ..	Slightly rusty ; badly laid, inclined to be coarse.
26	Skinless	Hawkesbury Agricultural College.	1 2 20	9 4 2 16	29 ,, ..	Very rank, rusty, and badly laid ; yield affected by caterpillars ; just in ear.
27	Welcome	Experimental Farm, Bathurst	3 0 0	16 10 0 0	29 ,, ..	Very coarse, rank, and rusty ; just coming into ear.
28	Algerian	Yates & Co.	2 0 10	11 7 3 12	29 ,, ..	Badly laid ; hardly any rust and inclined to be coarse.
9	Danish Island	Experimental Farm, Bathurst	No weight taken.			Almost entirely eaten by caterpillars ; very late and very coarse.

Owing to the necessity of harvesting the varieties when we did, and the difficulty experienced in many cases, of separating the tangled mass, accurate comparisons as to prolificness, which should be based upon the yields obtained, cannot be made between the different varieties. The results will, however, indicate which are the very heavy yielders and which consequently are the most suitable for ensilage, for which purpose leafiness and coarseness of straw are not drawbacks.

There were only three varieties which were at all fit for haymaking purposes. These were "Argentine," "Algerian," and "Red Rust Proof," and were most valuable in the order named. "Argentine"

Welcome.

Wide Awake.

Red Rust Proof.

and "Algerian" are very similar, but the former is slightly earlier, finer in the straw, more upright and more rust-resistant, though "Algerian" is a very good hay wheat. "Argentine" is much better in a wet season. Its superior qualities were quite noticeable as it was growing alongside the "Algerian." If a quantity of seed of the same strain can be secured it will prove a valuable acquisition. The seed was received from Mr. Valder per the Board of Exports as being of the variety imported into South Africa from the Argentine. The grain received very closely resembles Algerian. It was not a clean

sample but was weevily and mixed with weed seeds. Mr. Musson, to whom the sample was submitted, reported that it contained weevils and foreign seeds, probably mustard, wheat, black oats and linseed.

Skinless.

Reputed Tartarian.

"Algerian" was very suitable for hay, but was inclined to be rather coarse and flaggy. It was, however, infinitely superior to the other varieties, "Argentine" excepted. "Red Rust Proof" was only slightly rusty but was rather coarse and it is evidently a variety more suitable for ensilage than for hay.

Trial of a New Garton Oat.

On 22nd June, 1903, Messrs. Yates & Co. very kindly presented the College with a quantity of Garton oats lately imported for trial. It was planted on 25th June, 1903, and compared with Algerian. Each variety was sown in drills and occupied six plots, each two drills wide and 3 chains long. The plots occupied by each variety were arranged alternately.

The drills were 18 inches apart, the seed was sown thickly in the drills by a hand seed drill.

The Algerian variety was cut just after it had passed the flowering stage on 17th November, 1903. The Garton variety was cut at the same time just as it was coming into ear. This was necessary on account of

the damage being done by caterpillars, which had destroyed some and were rapidly destroying the whole of the foliage, thus affecting the weight obtained. The Algerian was only very slightly, if at all, attacked by the pest.

The yields obtained are as follows:—

Plots 1, 3, 5, 7, 9, and 11. "Algerian," 1,439 lb.	Computed yield per acre, 7 tons 17 cwt. of green stuff.
Plots 2, 4, 6, 8, 10, and 12. "Garton," 1,440 lb.	

It will be seen that the yields per plot are practically equal when the damage done by the caterpillars is taken into consideration. It is evident that the Garton oat is the heavier yielder. It is a stouter and more vigorous grower but not as rust-resistant as Algerian. The leaves are broad, limp, light dull green in colour and very rusty. It was not laid by the rain. This variety is hardly likely to prove suitable for hay in this district but may be valuable for greenstuff and ensilage.

Trial of a New Oat, "White Ligoun," from France.

This variety was received from the seed branch of our Department on 8th July, 1903, and planted on 20th July, 1903. It was compared with "Algerian" in the same way that the Garton variety was. Each variety occupied three plots. Both varieties were harvested on 19th November, 1903, at this date the "Algerian" was well out in flower, and "White Ligoun" just commencing to flower. The army worm had attacked the "White Ligoun" and almost denuded it of foliage. The yields of the portions of the plots weighed are as follows:—

Plots 1, 3, 5, "Algerian," 313 lb.; computed yield per acre, 5 tons 2 cwt. 0 qrs. 16 lb.

Plots 2, 4, 6, "White Ligoun," 255 lb.; computed yield per acre, 4 tons 2 cwt. 2 qrs. 0 lb.

Ligoun.

The yields obtained, on account of the damage done by the army worm, afford no opportunity of estimating the value of this new variety. The straw of this variety is soft and has broad limp leaves very liable to rust which discolours them badly. It is a leafier variety than "Algerian" and about a fortnight later. The head is clustering, the panicles remaining rather close to the stalk somewhat resembling "Clydesdale" in habit.

A Comparative Trial of Green Fodders suitable for Sheep, Pig, and Poultry Feed.

GEO. L. SUTTON,
Experimentalist, Hawkesbury Agricultural College.

The crops tried were Rape, Champion Ox Cabbage, Large Drumhead Cabbage, Green Kohl Rabi, Purple Kohl Rabi, and Thousand-headed Kale. These are the ones considered most suitable for supplying green succulent food to pigs, sheep, and poultry during the winter months.

The object of the experiment is to determine—

(1) Which is the most profitable crop to grow.

(2) How best to maintain a continuous supply of succulent green stuff during the season when these crops are available.

To obtain this information it will be necessary to continue this experiment annually, and with such modifications as the results obtained each season indicate as desirable.

Rape is the best known of the crops tried, and is of unquestioned merit. It has, therefore, been made the basis with which all the other crops can be compared. A plot of it was planted on each side, and adjacent to each of the other plots, containing the different crops under trial. The yield of each crop can, therefore, be compared with the yields of the adjacent plots of rape. By adopting this plan, and comparing each of the various crops with the plots of rape growing alongside them, a better idea of their relative value can be obtained than if the different crops were growing in plots adjacent to each other, and their respective yields compared. The differences in yield due to unevenness of soil are lessened, and crops growing on soils quite dissimilar in character and quality may be satisfactorily compared.

In order to facilitate the making of comparisons, the yield of the two plots of rape growing on either side of each of the other crops has been averaged and expressed as 100 in one of the columns of the table detailing the results. The yield of each of the other crops is also expressed as a percentage of the average yield of the two plots of rape between which it was growing.

All the plots were not on the same block of ground. Rape and Kohl Rabi were grown on Block A IX. Rape, the cabbages, and Thousand-headed kale were grown on Block B IX. The soil of these two blocks is by no means similar. That of Block A IX is very much inferior to that of Block B IX. In addition, the yields on A IX were seriously affected by excessive wet and poor drainage.

Each of the crops was planted in drills 3 feet apart; the plots devoted to them were uniform in size and shape. They were 6 drills wide and 5 chains long.

The rape and Kohl Rabi were planted in their permanent situations by means of the "Farmer's Friend" seed drill. Three pounds of seed per acre were sown. The Kohl Rabi was subsequently thinned out, leaving single plants 18 inches apart. The rape was not thinned out. The seed was sown on 8th April, 1903. On the following day plants of the cabbages and kale were set out from seed-beds, where they had been sown some six weeks previously. The plants were placed 2½ feet apart in the drills. Owing to showery weather prevailing subsequent to the transplanting no misses occurred. The various crops were horse-hoed three times during the course of the experiment, this was as often as the condition of the ground would admit. The season was especially favourable for crops of this character, though rather wet for badly-drained land.

The whole of the produce of each plot was not weighed. When harvesting, and before weighing, the outside drills and the ends of the other drills were removed, so that the results obtained would not be affected by external influences. The portion weighed consisted of four drills, each two chains long, situated in the centre of the plot.

The results are as follows:—

COMPARATIVE trial of Green Fodder Crops, suitable for Pigs, Sheep, and Poultry.

Plot No.	Name of Crop.	Yield per portion of plot weighed.			Computed yield per acre.				Percentage yield compared with Rape.
		cwt.	qrs.	lb.	tons	cwt.	qrs.	lb.	
B IX, 1	Rape, "Broad Leaf D. Essex" ...	15	0	12	20	15	1	22	100
2	Cabbage, "Champion Ox"... ...	16	1	6	22	8	1	11	107
3	Rape "Broad Leaf D. Essex" ...	15	1	8	21	1	1	10	100
4	Cabbage, "Large Drumhead" ...	11	3	22	16	8	2	3	72
5	Rape, "Broad Leaf D. Essex" ..	17	2	6	24	2	2	25	100
6	Kale, "Thousand-headed" ...	19	2	14	26	19	2	21	104
7	Rape, "Broad Leaf D. Essex" ...	19	0	12	26	5	1	22	100
A IX, 1	Rape, "Broad Leaf D. Essex" ...	9	2	8	13	3	0	24	100
2	Kohl Rabi, "Green"	7	1	8	10	1	1	10	85
3	Rape, "Broad Leaf D. Essex" ...	7	2	24	10	12	0	16	100
4	Rape, "Broad Leaf D. Essex" ...	8	3	4	12	1	2	12	100
5	Kohl Rabi, "Purple"	6	1	12	8	14	3	8	68
6	Rape, "Broad Leaf D. Essex" ...	9	3	14	13	14	0	2	100

From these results the varieties can be arranged in following order of merit as regards yield:—

Cabbage—"Champion Ox"...	107
Kale—"Thousand-headed"...	104
Rape—"Broad Leaf Dwarf Essex"	100
Kohl Rabi—"Green"	85
Cabbage—"Large Drumhead"	72
Kohl Rabi—"Purple"	68

The rape was harvested on August 29th, 1903. It was then considered to be at its best. This judgment proved correct, for shortly afterwards signs of "going off" were plainly visible. It flowered on

September 18th, 1903. At this stage it was too fibrous and woody to be of much use. As rape is fit for feeding at a very early stage of its growth, and a profitable return may be expected five or six weeks after planting, we may conclude that rape will furnish green food for about twelve or thirteen weeks, and during a period extending from the end of May to the end of August.

Both varieties of Kohl Rabi matured evenly and together. They were harvested on September 30th, 1903. These crops this season exhibited no qualities worthy of special recommendation.

The cabbages were cut as they formed solid hearts, or, in the cases of those plants which failed to form hearts, as they exhibited signs of running to seed. The "Champion Ox" Cabbage produced a succession of feed from August 8th to October 2nd, 1903; the "Drumhead" variety was a little later, and produced suitable feed from August 19th to October 22nd, 1903.

Thousand-headed kale, though not at its best, was quite suitable for feeding by the beginning of September, just as the rape was showing signs of flowering. The kale was harvested on October 2nd, 1903, when some of the earliest plants were commencing to run to seed. It was in full flower about the middle of October, when its usefulness as a fodder may be considered ended.

The foregoing observations are presented in a convenient form in following table.

TABLE showing the periods when the various crops are available for green feed.

Crop.	When planted.	When available for feed.
Rape, "Broad-leaf D. Essex" ...	8/4/03	May 30th, 1903, to August 30th, 1903
Kohl Rabi, "Green and Purple"	8/4/03	Sept. 1st, 1903, to Sept. 30th, 1903
Cabbage, "Champion Ox" ...	1/3/03*	August 8th, 1903, to October 2nd, 1903
Cabbage, "Large Drumhead" ...	1/3/03*	August 19th, 1903, to October 22nd, 1903
Kale, "Thousand-headed"	1/3/03*	September 1st to October 14th, 1903

*Transplanted, 9/4/03.

From the foregoing results it will be seen that of those tried the heaviest yielding crops are "Champion Ox" Cabbage, "Thousand-headed" kale, and "Broad Leaf Dwarf Essex" rape, and that by the aid of these three a continuous supply of green succulent food suitable for sheep, pigs, or poultry can be maintained from the end of May to the middle of October.

The Cattle Cabbage itself provides a continuous supply from the middle of August to the beginning of October, but as rape is the easier crop to grow, it is likely that it will be better to rely upon it for early green food, and upon kale for a later supply after the rape has ceased to be palatable.

THE FOOD OF CROPS.

H. W. POTTS.

The main object in a farmer's avocation is to convert soil and atmosphere into suitable food for man and domestic animals. The boundless stores of fertility in earth and air have to be intelligently utilised in producing wheat or oats from his paddock, fruit from his orchard, milk, butter, and cheese from his cow, beef or mutton for his butcher, wool for his clothier, and labour from his farm animals. Chemistry has not yet reached that point at which the elements can be adroitly combined to artificially manufacture food. We still, as in the days of yore, depend on nature's inscrutable laboratory, combined with man's guidance and intelligence, to bring forth our vast food supplies. Nature is our good chemist, and life or organic movement is the mainspring of all development in plants or animals. Plant life and animal life contribute in the most perplexing unions to provide us with our daily bread. But many of nature's hitherto inviolable secrets have of late years been disclosed, and we are beginning to recognise that it is an essential factor to success in farming to utilise the information given to us by the researches of our chemists and bacteriologists. A great part of the material from which food is produced is obtained from the vast supplies of nitrogen and other nourishing gases in the air we breathe, but the important part of it is derived directly from the soil. Whilst the atmosphere provides adequate supplies this is not the case with the soil. The soil, when analysed, will be found to furnish a supply of plant-food, which has lain, in many instances, dormant since creation. This, however, is limited. Examples are numerous also to show that plant-life has pursued an unbroken course of growth for centuries without loss of health and vigour. A prominent writer states: "The processes of nature are such that the same material can be used over and over again as food, passing from plant to animal and from animal to plant in an endless cycle, and as long as the energy of sunlight falls upon the surface of the earth to keep food supply in motion through this cycle, so long is it possible for the fertility of the soil to continue undiminished. It is upon the continuance of this food circulation that agriculture is dependent." The fertility of soil depends on its containing all the organic and inorganic substances needed for the nutrition of plants in soluble or available form. The most vital factors in soil are bacteria. With every crop a portion of plant food is removed. A part is returned from the air; another part, however, is lost for ever if not returned by man. If all the ingredients of the crop are given back to the land its fertility remains undiminished. Such restitution is effected by bacteria, cultivation, manure and favourable climatic conditions. We cannot escape the law of restitution. To disregard this means failure of crops. The study of the cycle of nature's food is important. We find the chemical constituents of the soil and the atmosphere are the predominating

ingredients of man, animals and plants. The decay or rotting of all animals and plants returns to the soil those elements which go to fertilise it and provide food for future plant growth. In this change the study of the functions of bacteria is largely involved. The soil is full of living organisms, bacteria and fungi. Where warmth, moisture and ample food supplies prevail they are more prolific and more active. The very superficial layers of the earth are extremely rich in bacteria, the number varying according to conditions—10,000 to many millions per gramme. In sandy soil the number is small. The greater the amount of humus, mould or vegetable matter the greater the number of bacteria and growth. As we pass below the surface the number rapidly diminishes. In 3 feet or 4 feet the numbers are few, and at 6 feet they have disappeared altogether. To the activity of these organisms in soil we are indebted for the continuous releasing of plant-food, and without which we now know that this earth's surface would be absolutely uninhabitable. We have now transferred the application of bacteriology from the academic arena of science to every day life on the farm. It is known that the soil, animals and crops contain certain essential elements such as nitrogen, potash, phosphorous, magnesium, sulphur, sodium, iron, chlorine, silicon, and lime. Those subject to most rapid exhaustion in the soil are nitrogen, phosphoric acid and potash. They must be in proper proportions suitable for plant-food. Soils may contain them in full quantity, but may be sterile through absence of water or warmth. The physical nature of the soil is also a factor. Practical fertility, it will be noted, depends on many conditions. One acre of maize of fifty bushels removes approximately 96·2 lb. nitrogen, 32 lb. phosphoric acid, 56 lb. potash. One acre of wheat of thirty bushels removes about 29½ lb. nitrogen, 9½ lb. phosphoric acid, 13½ lb. potash. Nitrogen is the most expensive constituent of all fertilisers. We know that every crop removed from the land, such as grain, milk, roots and flesh, takes with it certain plant-food in varying proportions, and whilst the soil contains vast stores of plant-food, our business is to release it. An axiom every farmer should have in mind is: "That all sources of manures or fertility from the farm and its surroundings should be fully utilised before resort is had to purchased plant-food." A manure is a substance necessary to the growth of a crop, and not contained in the soil in sufficient quantity or in proper form for immediate consumption. There are bulk manures and soil dressings available in New South Wales to the farmer from which he can secure in an economic way fertilisers—such as farmyard and animal manures, also bird manures of all kinds. Refuse from wool-sheds, abattoirs, digestors, blood, hair, horn, &c; refuse from boiling-down works, cattle-yards, glue, starch, jam factories, canning works, rabbit-preserving works, tanneries, gas-work retorts, brick and tile yards, market shops, the refuse from fires, turf skimmings (the most abundant and valuable dressings); deposits of soil and humus on flats, in gorges, dry beds of creeks, streams, lagoons, rivers, dredgings from rivers, lakes, and billabongs; nightsoil, road scrapings, street sweepings, drainage from sewers and cess-pits, malt dust, rotted hay

and straw, maize stalks, swamp grass, leaves and bush-rakings (when fermented and decomposed); peat and rich fibrous soil from old bog lands; guano existing in caves inland (bats) or by the sea shore on islands; fish refuse, coal-dust, coal-ashes, sea-weed, sea-shells and shell drift (which occurs even inland); lime, marl, gypsum, ashes, and sand. Green manures—peas, beans, cowpeas, vetches, lupins, soy-beans, velvet beans, tangier peas, clover, lucerne, rye, barley, rape, mustard, dandelion, weeds, &c. One of the main features of manuring is to return humus to the soil either in the form of stubbles, the roots of crops, green manures, the dung of grazing animals or farm-yard manures. Humus increases the water-holding and retaining capacity of the land. It improves its physical and mechanical condition, renders the soil more easily ærated, adds bacteria to the soil, and provides food for their growth and propagation. Deep and thorough cultivation means enhanced profits, and is the first consideration of every skilled farmer, combined with suitable drainage. The stores of plant-food lying latent and sterile at a depth need the reviving influences of sunlight, air, moisture and bacteria. These agencies release and render soluble and available the chemical constituents essential to the growth of plant life. The first consideration is the fixing of nitrogen from the atmosphere in which soil bacteria render great service. This is effected in a metabolic sense by the products of bacteria nitrifying the soil or chemically changing the insoluble nitrites to soluble nitrates. Food that has lain for centuries is thus brought into requisition. Bacteria require food, which they obtain from organic matter, and which they decompose or cause to decay; they need oxygen from the air, and further need moisture to stimulate their growth and functions. Green manure is produced by any crop that is grown primarily for the purpose of improving the soil and not for its harvested product. It is found in sound farming practice to grow these between ordinary crops to either plough them in or feed them off with any of the domestic animals, preferably sheep. (1) The chief aim of green manuring or by turning in green crops is to increase the supply of humus, organic matter or mould in the soil. The term is applied to some quickly-growing crop which is ploughed in green; and that is best conducted when the crop is young and during warm weather, so that it may decay, rot, or decompose rapidly. (2) Not only does this form of manure add humus to the soil, but improves its physical condition or texture. The soil is made more friable and looser, and more easily ærated. Moreover, in our warm climate it increases the moisture-holding capacity of the soil and makes it more retentive. Two classes of plants are used for the purpose of green manuring: (1) Rape, rye, buckwheat, cape barley, dandelion, mustard, and weeds. (2) The leguminous crops—peas, beans, soy-beans, lupins, cow-peas, clovers, vetches, pea-nuts, lucerne, &c. With the leguminous crops is secured the dual advantage of not only adding humus to the soil, but also transmitting stores of nitrogen from the atmosphere to the soil, by indirectly releasing plant-food and by rendering it available. Cowpeas, soy-beans, tangier pea, can be grown in summer; clovers, peas, vetches or tares, &c., in winter.

Crimson clover and black vetches are both valuable fodder plants in this district.* Experiments showed that a crop of clover 13 inches high on one acre produced 168 lb. nitrogen, equal to £5 worth of nitrogenous manures. Catch crops or cover crops are also a distinct gain to exhausted soils. Take such a crop as rape, which can be grown during the winter instead of allowing the ground to lie idle or growing weeds. It breaks up the subsoil and admits air. It brings up from below stores of potash and phosphoric acid, and leaves them on the surface for the next crop. The green herbage can be fed off with sheep, the most useful of domestic animals in returning nitrogen and other valuable constituents to the soil in their excreta. Such a crop prevents winter rains washing or leaching away into drains, gullies, creeks and rivers, large stores of soluble plant-food. The roots turned in add to the humus of the soil, and act as a mulch. "Never let the soil lie idle," is a sound axiom. Loose soils are made firmer, and more retentive, sandy soils are built up and made more fertile, clay soils become lighter and more friable. Feed off catch crops with sheep, pigs, or cows, and return to the soil a large proportion of the manure. Every crop sold off the farm means a dead loss of fertility. The mechanical, bacterial, and fertile condition of the soil is always benefited by catch, cover, or green manure crops—for the growth of which we have a suitable climate. In leguminous crops we have absolute evidence of the presence of myriads of bacteria in the nodules or warty excrescences on the roots of the various plants—their functions being to throw off certain compounds which combine with others to release the surrounding insoluble plant-food. Any crop or weeds will act as a green manure. The aim is to keep some kind of crops on your land all the time, and to change it from crops that rob the land of fertility to those which are soil renovators, and increase its plant food. You may be in a position to economically supply the requisite manure, or the soil may be rich enough to stand cropping for years; in such cases a rotation is not indicated. The main object is to arrange a series of crops in rotation to maintain fertility. The law of rotation, or the class of crop, is determined largely by climatic conditions and soils. Cowpea is a good crop, to be followed by maize, and this followed by a root crop. Wheat sown after turnips or potatoes is always likely to yield more heavily. The object throughout is never to allow two crops following each other which require the same ingredients or fertilisers. Follow a deep-rooted crop with a surface-feeding plant. Alternating the crops on such lines ends in augmented fertility. A Dutch farmer's wealth is estimated by the number of windmills he owns, but the wealth of a German farmer is assessed by the size of his manure heap. Farmyard manure is the basis of all effective fertility. It is lasting in character, provides nitrogen, phosphoric acid, potash and organic matter, retains moisture, and conveys innumerable bacteria to the soil. There is nothing on the farm with a more varied value, which is often determined by the class of animal housed, the feed, the litter used,

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* Hawkesbury District.

and the methods adopted in collecting and conserving the manure. In every instance chemical analysis has shown that the liquid manures are more than double the value of the solids from a manurial point of view; they are more rapid in action, and contain more soluble plant-food. Since better knowledge of the fermentative processes has been acquired it is now known that the best practice is to combine the liquids with the solids. All manures should be placed in a covered shed with a solid floor, stiff clay or cement, the solids to be intimately associated with the liquids. All refuse or manure from stables, cow bails, and pig styes to be collected as rapidly as possible, especially horse manure. If there be no suitable means of protecting it from the weather until the fermentative changes have been secured, then the sooner it is put on to the land the better. One ton of farm-yard manure contains approximately: 8 lb. nitrogen, 6 lb. potash, 6 lb. phosphoric acid. A ton of ordinary farm-yard manure will contain fertilising elements equal to from 12s. to 15s. worth of artificial fertilisers. The old Scotch system of conserving farm-yard manure would do well in cold countries where the cattle are housed. Here, however, with our warm climate and need for sanitary conditions, the manure is best conserved in a sheltered place or placed quickly on the land. The nitrogen in farm-yard manure does not supply all that is needed, and this may be balanced or supplied in artificial form. In this rapid and cursory review of the Food of Crops I am unable to include the question of the use and abuse of chemical or artificial or commercial manures; it would require a separate lecture to deal with a subject of such vast importance. Further, the question of the application of bacteria to every day use on the farm needs further elucidation, and if thought desirable I will gladly take up these subjects on future occasions. The subject of Food for Crops in our warm and exhausting climate is one that demands serious consideration. The wondrous power in the hands of our agriculturists, if intelligently applied, must add to the sum of our food products, raise the general tone of agricultural life, increase the attractiveness of a rural occupation, and make farmers wiser and wealthier men.

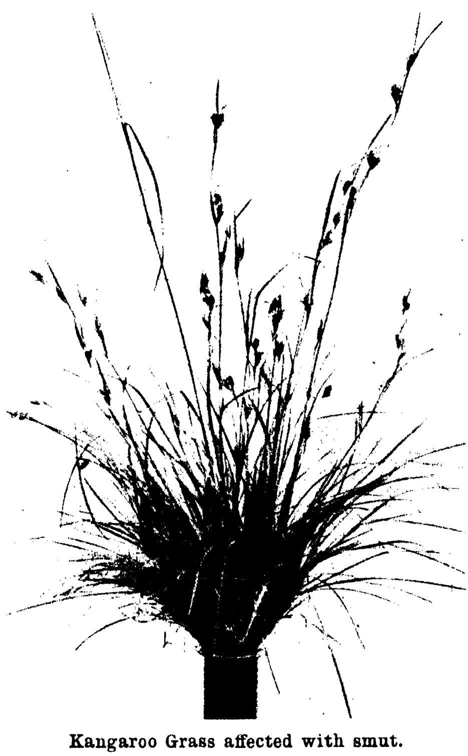
A Smutted Grass: Kangaroo. *Anthistiria ciliata.*

C. T. MUSSON.

The stunted growth in flower-stalks of example shown is due to the attack of smut, a fungus parasite living within the tissues of the plant. As the grass grows, the fungus within also grows. When the time arrives for the grass to develop seeds, their place is taken by the fruiting organs of the parasite.

The chaff, which is of a whitish colour, encloses, instead of a seed, immense numbers of tiny spherical dark-coloured spores (which act like seeds in being able to develop into a new plant) which look in the mass like soot. Many grasses are attacked by similar pests, most of them having their own particular parasites, either rust or smut.

All smutted grasses may be looked upon as detrimental to stock, though in most cases, perhaps, this cannot be proved. Certainly, however, the host plants are weakly and short of their full supply of material required for their sustenance (what is practically the undigested and digested food matter, and the substance which is the active living material within the tissues—even the plant skeleton is sometimes



Kangaroo Grass affected with smut.

rotted by them). No seed being formed, the grass as food for stock has lost one of its principal ingredients.

Burning off destroys these powdery spores, which cannot then be spread by the wind to infect other plants. Although this would not entirely destroy the parasite it would, if followed out, largely help to keep the disease in check.

International Egg-laying Competition.—Second Winter Test.

D. S. THOMPSON, Poultry Expert, Hawkesbury Agricultural College.

Towards the end of the First Annual Laying Competition, the enthusiasm of every one in connection with it had increased so much that in justification the committee decided to have the number of pens increased to try and accommodate the large number of breeders so anxious to take part in those educational contests. The Minister of Agriculture was approached, and he at once granted the request of the Committee and sanctioned the erection of an additional twenty-eight pens, increasing the number from forty-two to seventy. Even this number was not sufficient, and a good many earnest and willing competitors had to be shut out for want of pens.

From the experience of the first laying competition the Committee were enabled to make some improvements in the conditions governing the contest, notably, the penning of the birds to be all as near one uniform age as possible. This was done simply by restricting the entries to pullets under twelve months, not with the intention of controlling the competitors, but simply with the view of uniformity for the collection of data. However, the intention of the Committee failed to some extent; seeing the Committee named a maximum, and no minimum was fixed, many competitors sent in chickens. The Committee were not to blame for this, as they simply depended on the experience and good sense of the competitors. Many breeders made the mistake of thinking that, because Leghorn pullets would often lay at four or five months, on attaining that age in September or October, they would lay at the same age in April or May. The competition has demonstrated that such is not the case, and competitors themselves are not likely to repeat the same mistake. The Committee will not give them the chance in the third annual competition, a minimum of seven months having been determined. The present competition was made an international one by the entry of three pens from America, and the interest surrounding these pens has been very great in the State and throughout Australasia, while it has also extended to America, Canada, England, and other countries.

The season throughout the winter test has been a very good one, favourable to egg production. The weather has been genial and mild, with splendid rains, and the surface of the pens has been in a fine green state throughout. The American hens arrived in very poor condition, but with careful treatment, good housing, healthy environment, and clean quarters, coupled with favourable climatic conditions, they were successfully nursed through their sickness, and have given a good account of themselves. The little Rose-comb Brown Leghorns topped the list, and won the winter test with a magnificent total of 711 eggs, for six months, or an average of 118·5 eggs per hen, the average weight being 24 oz. per dozen, and the market value £5 1s. 2d., or an average of 16s. 10d. for each hen. This result is remarkably high,

and in our opinion could not be approached in any other part of the world. Already we note the critics saying, "I told you so," and giving their opinion that it was the softest thing in the world for the Americans, the conditions suiting them to a T, and now our State is going to be ruined with an illegitimate run on fowls without any warranty. All we would say to these critics is, that we hope they will avail themselves of the same opportunity by sending a pen to the first American competition, and if they succeed in sending a pen to America that will break the record of 200 eggs per annum for each hen of the six, they will do more good for the State than if they write reams of matter as captious critics on the doings of the American pens in the competition of their own State. They will have a far larger market in America than the Americans have here, and I am sure the Americans will not discount the performance of any Australian pen that can go to America and carry off the first prize in a competition of 70 pens with a performance of over 200 eggs per hen for six hens for the twelve months.

An Australian pen of Silver Wyandottes laid 693 eggs, or an average of 115·5 eggs, of an average weight of 24½ oz. per dozen, and an averagé value of 16s. 4d. per hen; a truly remarkable performance, to which the owner and the State can justly point with pride. It is not desired to discount the performance of the American pen in any way, but it may be pointed out that the fact of the American pen having won the winter test, while it undoubtedly points to the fact of their being an excellent laying strain, it does not demonstrate that Rose-comb Brown Leghorns will be found winter layers.

The competition, so far as it has gone, has been a remarkable success, both in the splendid results obtained and the important material influence it has exercised throughout Australasia in stimulating breeding with a view of improving and developing the utility side of poultry-keeping. The prize-winners for the winter test were:—

Mrs. Hansel, of America, Rose-comb Brown Leghorns—First, £5.
G. Howell, of Wentworthville, Silver Wyandottes—Second, £4.
W. H. Ponton and Son, Tuggerah Lakes, Langshans—Third, £3 10s.
A. Munro, Rockdale, Buff Leghorns—Fourth, £3.
W. K. Hays, of America, White Wyandottes—Fifth, £2 10s.
R. E. Warren, Richmond, Silver Wyandottes—Sixth, £2.
S. Kendall, Kiama, Silver Wyandottes—Seventh, £1 10s.
W. Wild, Lake Albert, Black Orpingtons—Eighth, £1.
J. Varley, Rookwood—Ninth, 10s.

We are accumulating valuable deductions from these competitions, and amateurs in the poultry world are undoubtedly securing practical information from its object lessons. That we have gained considerably can easily be understood by the fact that the average per pen from the forty-one pens competing in the first winter test was 342·6 eggs per pen, or an average of 57·10 per hen; while for the second winter contest the average for 70 pens was 470 eggs per pen, or an average of 78·35 per hen, truly a notable increase. Surely no one will have the temerity to say that this magnificent advance could be obtained without increased knowledge on the part of the competitors and all concerned.

The monthly laying returns for the forty-one pens in the first winter test was, April 756, May 1,090, June 1,630, July 2,839, August 3,346, September 4,386—grand total, 10,047; and the monthly laying for the second winter test for seventy pens was, April 1,284, May 3,124, June 4,821, July 6,636, August 8,577, September 8,476—grand total, 32,907.

The feeding was of the simplest nature, bran and pollard mash mixed with liver soup for the morning meal, fed at 7 a.m., grain for the evening meal, fed at 4 p.m., cut up livers twice a week, shell grit always before them, and clean water every morning. The grain was wheat and maize, but on account of the abnormal price of wheat the evening meal consisted almost entirely of crushed maize throughout the winter test.

The cost of feed was—grain, £34 17s. 8d.; pollard and bran, £11; meat, £7 10s.; shell grit, 12s. 6d.; total, £54 0s. 2d.

The total value of eggs laid was £192 17s. 10d., leaving a profit of £138 17s. 10d. for the six months, or an average of 6s. 7d. per hen, compared with 3s. 8d. per hen for the first winter test—an advance of nearly 100 per cent.

The following conclusions are taken from the actual weight of eggs as recorded:—

Silver Wyandottes, actual weight recorded from each pen (in ounces), 24, 24, 24, 25, 24, 24½, 27½, 26, 23, 26½.
White Wyandottes, 26, 25½, 23, 26.
Golden Wyandottes, 26, 24½, 25½, 24½, 25½.
Buff Wyandottes, 23.
Buff Orpingtons, 28, 26½, 26, 26½, 25½, 28, 28½, 24, 27, 25.
Black Orpingtons, 25, 24, 26½, 27½, 25½, 26, 22½, 27½, 26½, 27, 24½, 27, 25½, 23½, 24.
Diamond Jubilee, 26½.
White Leghorns, 25½, 27½, 28½, 28½, 27½, 26, 27, 26, 30½, 29½, 27½, 27.
Brown Leghorns, 24.
Buff Leghorns, 25½.
Minorcas, 27, 29.
Andalusians, 25½, 27, 25½, 28½.
Langshans, 26½, 26.
Anconas, 24½.

From that list of actual recorded weights, which is the first published in the world, we make the following deductions:—General average weight of the eggs of the various principal varieties, graded—

Brown Leghorns, 24 oz.
Buff Leghorn, Ancona, and Silver, Golden, White, and Buff Wyandottes, 25 oz.
Langshan, Black Orpington, and Jubilee Orpington, 26 oz.
Buff Orpington, 27 oz.
White Leghorn and Andalusian, 28 oz.
Minorca, 29 oz.

The conclusions bearing on the size of the eggs and the laying capacity of the varieties and strains will be of great interest. We found that the leading pens in the Silver Wyandottes, viz.: Howell, Warren and Kendall, were all under the average size of 25 ozs. In Black Orphingtons it was found that the leading pens, viz.: Wild, Rone, Bastin, Harris and Wedlich, all laying under the average weight or just up to it. While in Leghorns all the leading pens were under the average size. The same thing occurs again in Andalusians, the two Evendens who are ahead of the other two pens are laying a

25½ oz. egg, compared with 27 and 28 oz. for the two pens behind them. The following is an analysis of the breeds for each month for the full six months of the second winter test, giving the average in numbers of eggs laid for each month and the average in values for the first three months and the full six months.

It will be remembered that it was predicted after running the first competition, that Silver Wyandottes would be found topping the list in this and future competitions, and it will be clearly seen that they carry off that honor, being twenty-four eggs per pen ahead of the next best variety, viz., the Black Orpingtons, and no less than 6s. 8d. per pen ahead of the same variety, which stamps them without cavil, *the best winter laying variety in this State.*

Variety.	No. of Pens.	Eggs.	Average.
Averages in Varieties for April.			
Silver Wyandottes ...	10	306	30·6
White Wyandottes ...	3	53	17·6
Black Orpingtons ...	14	198	14·1
White Leghorns ...	12	153	12·7
Andalusians	4	41	10·2
Buff Orpingtons ...	10	82	8·2
Golden Wyandottes ...	5	20	4·0
Averages in Varieties for May.			
Silver Wyandottes ...	10	543	54·3
Andalusians	4	185	46·2
Buff Orpingtons ...	10	428	42·8
White Leghorns ..	12	461	38·4
Black Orpingtons ...	14	534	38·1
White Wyandottes ...	3	93	31·0
Golden Wyandottes ...	5	104	20·8
Averages in Varieties for June.			
Buff Orpingtons ...	10	756	75·6
Black Orpingtons ...	14	1,043	74·5
Silver Wyandottes ...	10	741	74·1
Andalusians	4	216	54·0
White Leghorns ...	12	647	53·9
White Wyandottes ...	3	161	53·6
Golden Wyandottes ...	5	244	48·8
Averages in Varieties for July.			
Silver Wyandottes ...	10	1,119	111·9
Andalusians	4	395	98·7
Black Orpingtons ...	14	1,363	97·3
Buff Orpingtons ...	10	895	89·5
Golden Wyandottes ...	5	444	88·8
White Leghorns ...	12	1,002	83·5
White Wyandottes ...	3	247	82·3
Averages in Varieties for August.			
Golden Wyandottes ...	5	591	148·2
Black Orpingtons ...	14	1,824	130·2
Andalusians	4	509	127·2
White Leghorns ...	12	1,482	123·5
Silver Wyandottes ...	10	1,223	122·3
Buff Orpingtons ...	10	1,207	120·7
White Wyandottes ...	3	307	102·3
Averages in Varieties for September.			
White Leghorns ...	12	1,577	131·5
Andalusians	4	520	130·0
Black Orpingtons ...	14	1,754	125·0
White Wyandottes ...	3	355	118·3
Golden Wyandottes ...	5	588	117·6
Buff Orpingtons ...	10	1,136	113·6
Silver Wyandottes ...	10	1,103	110·3
Averages for the Full Six Months per Pen.			
Silver Wyandottes ...	10	5,035	503·5
Black Orpingtons ...	14	6,716	479·7
Andalusians	4	1,866	466·5
Buff Orpingtons ...	10	4,504	450·4
White Leghorns ...	12	5,322	443·5
White Wyandottes ...	3	1,215	405·0
Golden Wyandottes ...	5	1,991	398·2

Averages in Values for Three Months per Pen.

	£	s.	d.
Silver Wyandottes	1	9	10
Black Orpingtons	1	3	2
Buff Orpingtons	1	3	2
Andalusians	1	0	8
White Leghorns	0	19	10
White Wyandottes ...	0	18	11
Golden Wyandottes ...	0	4	0

Averages in Values for the full Winter Test.

	£	s.	d.
Silver Wyandottes	3	1	7
Black Orpingtons	2	14	11
Andalusians	2	12	8
Buff Orpingtons	2	12	2
White Leghorns	2	9	7
White Wyandottes	2	6	0
Golden Wyandottes	2	4	7

Hawkesbury College Laying Competition.

REPORT TO SEPTEMBER 30TH, 1903—WINTER TEST.

Owner, Address, and Breed.	Age—Months.	Eggs Laid.							Weight of Eggs per doz.		Market value
		April.	May.	June.	July.	August.	September.	Totals.	First quarter.	Second quarter.	
									oz.	oz.	
Mrs. A. H. Hänsel, U.S.A.—R. C. Brown Leghorns	11	103	130	115	110	117	124	711	24	24	101/2
G. Howell, Wentworthville—Silver Wyandottes	7	96	137	127	112	110	132	693	23	24	98/
W. H. Ponton & Son, Tuggerah Lakes—Langshans	7	15	91	106	139	145	142	647	25½	26½	80/6
A. Munro, Rockdale—Buff Leghorns	6	61	97	112	113	132	123	638	25	25½	84/9
W. K. Hays, U.S.A.—White Wyandottes	11½	86	116	160	112	114	101	620	24	26	88/9
R. E. Warren, Richmond—Silver Wyandottes	9	72	80	76	121	142	126	617	23	24	79/6
S. Kendall, Kiama—Silver Wyandottes	7	5	70	116	126	145	142	604	22	24	71/10
W. Wild, Lake Albert—Black Orpingtons	7½	33	80	110	108	131	136	598	23½	25	75/7
J. Varley, Rookwood—Buff Orpingtons	7	37	102	102	108	136	112	597	27	28	78/4
Mrs. N. Kirby, Ryde—Buff Wyandottes	9	10	60	129	124	123	133	579	23	23	71/
W. F. Evenden, Kogarah—Andalusians	7	1	58	101	128	140	145	573	25½	25½	66/10
E. S. Fuller, Kiama—White Leghorns	6¾	22	60	90	121	137	143	573	25	25½	68/6
J. Rone, Riverstone—Black Orpingtons	6	0	1	101	145	160	156	563	26	26	59/6
J. Ahern, Arncliffe—Silver Wyandottes	7½	15	76	107	114	130	119	561	25	25	70/
A. E. Henry, Ryde—Silver Wyandottes	8	75	75	68	106	115	114	553	23½	24	73/
Mrs. H. Bastin, Enfield—Black Orpingtons	7	37	61	104	101	122	121	546	22½	24	68/9
Mrs. Widmer, Drummoyne—Buff Orpingtons	7	4	39	118	116	135	133	545	25½	26	63/7
H. G. Lambert, Moss Vale—Buff Orpingtons	6½	10	69	66	132	145	116	538	25	26½	64/2
H. R. Harris, Neutral Bay—Black Orpingtons	5	0	41	70	140	150	137	538	23	25½	59/9
J. J. Roche, Bayview—White Leghorns	7	37	84	48	90	140	133	532	27½	27½	66/5
A. Wedlich, Balaclava (Vic.)—Black Orpingtons	7	11	51	95	110	131	132	530	24	26	62/6
A. Arnold, Ashfield—White Leghorns	6¼	1	39	93	128	135	133	529	28	28½	60/4
Mrs. E. Scaysbrook, Gosford—Black Orpingtons	11½	15	46	101	124	121	120	527	27½	27½	63/4
C. A. W. Weil, Ashfield—White Leghorns	7½	20	32	61	119	145	144	521	27	27½	58/
W. H. Tombs, Penrith—Anconas	7	39	54	42	98	139	145	517	24	24½	60/1
W. Gibson, Penrith—Jubilee Orpingtons	6	0	31	95	122	135	131	514	26	26½	57/10
C. F. Agst, Mulgrave—White Leghorns	5½	4	60	77	109	133	129	512	27½	28½	60/
C. H. Wickham, Killara—Black Orpingtons	11	19	59	85	82	137	122	504	22½	22½	60/5
H. S. Bignell, Bandon Grove—Golden Wyandottes	7	0	34	87	114	136	124	495	24	26	55/8
C. T. Burton, Hurstville—Buff Orpingtons	8	6	61	91	95	119	119	491	27	26½	59/3
W. B. Candee, U.S.A.—White Wyandottes	11	103	94	68	80	74	71	490	24	25½	72/9
E. Butcher, North Sydney—Black Orpingtons	8½	21	48	93	87	113	126	488	27	27½	58/8
Arcadia Poultry Farm, Arcadia—White Wyandottes	6	0	37	95	108	108	138	486	22½	23	55/8
D. B. and H. G. Elphinstone, Eastwood—Minorcas	8	15	42	78	78	125	141	479	26	27	54/9
E. Lomax, Narara—Black Orpingtons	7	52	44	30	68	141	134	469	24	27	54/4
F. Dahlgren, Narara—Buff Orpingtons	9	0	30	103	92	123	111	459	24	25½	53/
Mrs. A. J. Evenden, Bexley—Andalusians	7½	26	42	47	87	124	125	457	24	25½	53/1
D. Frewin, Gosford—Andalusians	6½	14	79	59	76	107	122	457	24	27	56/2
Horwood and Denis, Wagga—White Leghorns	8	18	26	46	97	134	131	452	25	26	49/1
M. Ward, Thornleigh—Black Orpingtons	5½	0	37	74	97	133	109	450	25½	26½	51/
E. J. Winton, Campbelltown—Langshans	6	0	32	92	108	112	105	449	27	26	52/1
J. F. Brown, Summer Hill—Silver Wyandottes	6	0	0	61	126	139	116	442	27	27½	45/8
C. Bridekirk, Enfield—White Leghorns	6¼	20	44	39	75	125	128	431	25½	27	48/4
Grantham P. Farm, Plumpton—S. C. White Leghorns	6	0	13	58	74	143	140	428	24	26	43/3
W. H. Lathlean, Waratah—Silver Wyandottes	8	15	46	45	96	132	92	426	24	24½	40/5
L. L. Ramsay, Carlingford—Black Orpingtons	6	6	39	64	77	106	134	426	25½	27	47/10
A. Beattie, Blackwall—Buff Orpingtons	8¾	17	36	61	78	110	114	416	28	27	48/2
A. Hallen, Toongabbie—Golden Wyandottes	6	20	59	50	58	120	104	411	23	24½	50/2
J. D. Parmenter, Berrima—Silver Wyandottes	7	9	23	47	123	113	85	410	25	26	46/11
W. B. Bull, Summer Hill—White Wyandottes	9	34	46	34	70	106	116	406	24	26	47/11
J. E. Pemell, Randwick—Golden Wyandottes	7½	0	11	51	108	112	116	398	24½	25½	51/10
A. T. Tipping, Burwood—White Leghorns	7	0	43	60	74	106	112	395	30	30½	45/
L. A. Wallace, Goulburn—Black Orpingtons	7½	0	19	79	68	131	98	395	24½	24½	43/5
W. Frame, Canterbury—Buff Orpingtons	10	0	1	41	80	133	136	391	26	27	36/4
Bosanquet Bros., Liverpool—Buff Orpingtons	6	0	47	61	79	100	92	379	23	28½	44/6
Brown and Jervis, Bowral—Andalusians	4½	0	0	9	104	138	128	379	26	28½	34/10
C. H. Bayley, Ashfield—Buff Orpingtons	7½	8	32	77	66	82	100	374	24	24	43/9
J. E. Robberds, Artarmon—Silver Wyandottes	4½	0	0	56	119	112	85	372	23	23	39/4
T. Bourne, Moss Vale—Silver Wyandottes	7½	19	36	49	76	85	92	357	26	26½	42/5
Mrs. J. Jubb, Pambula—Brown Leghorns	4½	0	26	32	52	126	120	356	20	22½	36/1
R. Newell, Petersham—Golden Wyandottes	6	0	0	50	79	105	119	353	24	24½	35/3
E. Waldron, Willoughby—Black Orpingtons	7	4	8	27	72	120	121	352	25½	25½	34/6
E. H. Maxwell, East-hills—White Leghorns	6	17	35	41	51	80	123	347	26½	29½	39/2
A. E. McLeod, Hermidale—Golden Wyandottes	6½	0	0	6	85	118	125	334	24	25½	30/2
Mrs. A. P. Lombe, Ashfield—Black Orpingtans	5	0	0	10	84	128	108	330	23½	24	30/4
W. Harris, Woy Woy—White Wyandottes	7	18	10	32	69	93	101	323	23	23½	34/5
C. B. Smith, Croydon—White Leghorns	7	14	24	20	23	102	135	318	25½	27½	32/1
H. Cadell, Epping—Buff Orpingtons	6½	0	11	36	49	124	94	314	25	25	31/2
Cardwell & Messervey, Leichhardt—White Leghorns	6	0	1	14	41	102	126	284	26½	27	25/
D. B. Bannister, Pymble—Minorcas	6	0	8	23	24	92	107	249	28	29	22/7

PEARL MILLET.

THE following additional information regarding the boomed forage plant, about which Mr. Maiden has issued a caution to the readers of this *Gazette*, may prove interesting to farmers :—Pearl Millett (*Penicillaria spicata*) has been grown at the College each season since 1900, when a supply of seed was obtained from Messrs. Hackett, of Adelaide. This plant has its use in farm economy, but by no means possesses the extraordinary qualities claimed for it by some American seedsmen. Its chief value lies in its extreme earliness. Six weeks after planting it commences to form seed heads, and a week or ten days later is fit for use as a greenstuff. The crop in the illustration is an example of this; it was sown November 24, 1903, and on January 8th, 1904, when the photo. was taken, it was breaking into ear. The staff in the illustration was 5½ feet high. The millet is about 5 feet high. [Unfortunately the negative of this photograph was destroyed before a reproduction could be made.—ED.]

From a farmer's standpoint, this plant is classed with the non-saccharine sorghums, as the stalks are coarse—much coarser than those plants usually known as "millets." It has a similar use, and is about as suitable for hay-making as any of the sorghums. It is hardy, and will grow in poor, heavy soil. Last year, during the drought, it yielded over 7 tons of greenstuff per acre on a very poor piece of soil, not proving as productive as the sorghums, but out-yielding the millets.

From the queries relating to this plant which have been received at the College during the last two years, it is evident that seed of this plant has been distributed under the names of *Penicillaria* and "Mand's American Wonder Forage Plant."—GEO. L. SUTTON.

FARM NOTES.—HAWKESBURY DISTRICT.

H. W. POTTS.

ALL over the district the favourable weather has produced phenomenal growth of all kinds. Much of this cannot be preserved in any other way but as ensilage. Stock-owners will do well to guard against scarcity during flood or drought by conserving their super-abundant forage in this way. Where a tub or pit is not available, stacks can be cheaply and successfully built.

Most of the growers will have completed the harvesting of their potato crops during this month. In many cases, the ground will be given over to the growth of weeds until the time for the preparation of spring crops is at hand, in other cases, the ground will be cultivated and kept fallow in order to keep it clean. Neither practice is satisfactory. On the one hand, seeds are produced which cause future trouble, and, in the other case, the soil is being depleted of vegetable matter, and during wet weather also of mineral matter. It has been estimated that during a normal season more plant food is washed out of the soil by rain than a crop would utilise.

A very much more satisfactory and profitable plan than either of those mentioned would be to sow the beds down with rape or rye. The ground need not be ploughed, but would be prepared, perhaps, better prepared, with disc harrow or cultivator; the growth of these plants would check weeds and would provide grazing for pigs or horses during the winter, the residues would add organic matter to the soil, and the roots would prevent loss of plant food by leaching.

Potatoes.—The autumn crop should be planted this month. Our potato-growers should take advantage of the opportunity they have of producing their own seed for spring planting. The high price usually charged in the Spring for seed potatoes, and the unsatisfactory and unreliable nature of the seed obtained, renders this course now absolutely necessary. In the present crop the "come-up" and the product of the seed which did grow are entirely unsatisfactory. The great disparity between the yields of locally-raised seed and the imported seed proves beyond dispute that it is not the fault of the season or the ground, but that the loss is due to the character of the seed. To this loss must be added the initial cost of the seed. The chief difficulty surrounding the growing of the Autumn crop appears to be in getting the seed sprouted in time for planting. This is a real difficulty, and has been recognised as such by our officers. Investigations have been and are being conducted to determine "How best to sprout the seed for this crop." The most satisfactory method found so far is—(1) To expose the potatoes after being dug to light, *but not direct sunlight,* for several days so as to toughen the skins; and (2) to spread them out when toughened in a warm place in a single layer, and to cover them with about 1 or 1½ inches of river sand, which should be kept moist, but not wet. Exposing to the light is apparently an important matter as it seems to prevent rotting; it, however, renders the potatoes unfit for domestic use.

The whole of the seed used last spring for experimental purposes—2½ acres—was grown from seed sprouted in this manner, and which was planted March 5, 1903.

Green Feed for Dairy—Sorghum.—Sowings of Black Sorghum or Planters' Friend may still be made. Drilling will give surer and more satisfactory results.

Barley.—Cape, Skinless and Beardless may now be sown for Winter green feed.

Wheat.—Some of the Macaroni varieties, if sown now, will provide a crop of greenstuff about June, and if allowed to remain will produce a crop of grain in late Spring. Medeah, Belotourka, and Farrer's Durum and Cretan are suitable varieties for this purpose.

Swede and other Turnips.—As favourable weather occurs, these crops may be planted. A little superphosphate sown with the seedwill help the plant over a critical period, and enable it to resist the attacks of the aphis. Those who possess maize-drills can utilise them for sowing this crop. (See "A Handy Seed Drill," *Agricultural Gazette*, p. 664, vol. XIV.) Owing to the unsatisfactory market rates ruling for Swedes during late years, it is unwise to grow large areas, unless provision be made for utilising the crop for stock feed shouldlow prices prevail.

Rape, Cabbage, and Kale—Rape.—This is an opportune time to sow this valuable plant. This crop is fit for use any time during its growth, and six weeks of favourable weather will produce a very profitable return. It can be fed off, or successive cuttings can be made until September. It may be sown either broadcast or drilled. Experiments indicate that when the drills are 2½ feet apart the most profitable returns are obtained.

Cattle Cabbage—1000-Headed Kale.—These crops may be sown in their permanent situations if the ground be ready and the weather favourable, or the seed may be sown in nursery beds, and the plants afterwards placed in the field. The Kale is of special value to small poultry keepers, as the bottom leaves may be utilised as required, and the plant will continue to grow upwards and produce new leaves.

Lucerne and Paspalum.—Towards the end of the month is the most favourable time for planting these crops in this district.

Lucerne.—As lucerne is a permanent crop, too much trouble cannot be taken to thoroughly clean the ground before planting the seed. In such a district as this it is found advisable to be liberal with the seed; use at least 20lb. per acre, and sow it evenly.

Paspalum.—Propagation by roots is more satisfactory than sowing the seed. Whilst this grass is hardy, and will grow and fight its way amongst other grasses, yet, on poor soil especially, it pays to prepare the ground. The grass grows better and more luxuriantly, and covers the ground sooner.

Crops for Winter Greenstuff.

Mr. J. R. Clarke, of Coopernook, on the Manning River, last March communicated with the Department with the object of obtaining advice as to the most suitable crop, or crops, to grow for greenstuff for milking cows. For a couple of years he had tried Allora Spring Wheat, but found that it became badly affected by rust. For experimental purposes, small quantities of seed of Emerald Rye, Skinless Barley, and Golden Giant Oats were forwarded, and the Department is now in receipt of Mr. Clarke's report on the growth of same.

The area chosen for the trial consisted of dark chocolate soil, 3 to 4 feet in depth, and of a loose nature. It had been previously cropped with maize, returning from 60 to 80 bushels per acre without manure. The soil was prepared by ploughing and disc-harrowing. Seed was sown at the rate of 1 bushel per acre towards the end of May, and in ten days after sowing the plants were well up.

The Emerald Rye was ripe and harvested on 10th December. The Skinless Barley and Giant Oats were both destroyed by rust.

The season was very favourable up to end of July; thence until harvest, rains were very frequent. The Emerald Rye attained a height of fully 6 feet, with a splendid stool, and the growth and character were all that could be desired. The Skinless Barley and Giant Oats grew remarkably well until attacked by the rust.

Farm Notes.

RIVERINA DISTRICT.—February.

G. M. McKEOWN.

Wheat for Hay.—March and April will be found the best months for sowing wheat for hay in this and similar districts. The prepartion of the land should therefore be commenced without delay. For early ploughing, the rotary-disc plough will be found invaluable. The land should be ploughed as deep as the nature of the soil will admit, and thoroughly pulverised. Forty-five pounds of plump seed will be found ample under local conditions. The seed should be sown with the drill, and with it about 60lb. per acre of No. 1 or No. 3 superphosphate. The cost of the fertiliser will not be more than 3s. or 4s. per acre, and the yield will be found to be largely increased. The Berthoud, White Essex, White Lammas and Australian Talavera are the best kinds, making hay of far better appearance than the purple straw varieties. The white wheats are also more palatable for stock. As soon as conditions will admit, the preparation of land for all grain crops should be commenced.

Oats.—Land should be got ready without delay, as seed should be sown in March. Not more than a bushel of seed per acre should be sown in dry districts, and manure should be used as recommended for wheat. Algerian and Dun will be found the best varieties for hay. For feeding off, Carter's Cluster and Tartarian will be found among the best kinds, as they get away quicker than those which are the best for hay, but they do not stand drought so well in the later stages of their growth.

Rape.—Prepare for sowing as early as possible, as seed should be sown after the first fair fall of rain. The soil should be brought into fine condition by means of harrowing and roling. The seed, being small, should be sown on a surface made as even as possible, and covered lightly. For broadcast seed the lever harrow will be the best covering implement. Two pounds of seed will sow an acre. Dwarf Essex is the best variety.

Vegetables, &c.—Swedes should be sown as soon as there is sufficient moisture. White turnips may also be sown in small quantities during the month. Sow cabbage and cauliflower in beds, for later transplantation, where shade and water can be applied. Pumpkins and melons should be cultivated, and watered where water is available. Stake and tie up tomato vines, keeping too luxuriant growth in check. Pick all fruit as it ripens.

BATHURST DISTRICT.—February.

R. W. PEACOCK.

Every effort should be made during the month to ensure green fodder throughout the winter months. The following crops are the most suitable for the purpose :—

Barleys.—These can be sown largely at intervals of a few weeks to ensure succession of fodder. The Skinless and Cape varieties are the best for the purpose. They require a soil in good condition, with a fair amount of available plant-food at the surface.

Ryes.—These can be sown to advantage on poorer soils than the barleys. The Black Winter and Arctic are suitable varieties, and produce a fair amount of green fodder throughout the winter. They are not as palatable to the stock as the barleys; successive sowings are advisable.

Wheat.—If some of the earlier varieties were sown this month they would provide excellent green fodder throughout the winter. If the later long-season varieties were sown towards the end of the month they would produce a fair amount of fodder to be grazed off judiciously throughout the early winter, and afterwards shut up for a crop of grain. Many good yields have been harvested from crops so treated.

Tares and Peas may be sown towards the end of the month, alone or in conjunction with the foregoing cereals. When so mixed, the fodder value of the resultant crop is much increased.

Rape should be sown largely upon well-prepared land. It is preferable to sow in drills about 2 feet apart, to allow of cultivation. It is one of the most valuable crops in a rotation, and leaves the land clean for a cereal crop the following season if required. It yields heavily upon good soil, and is an excellent fodder, especially for ewes and lambs and pigs.

Swede Turnips can be sown largely, requiring the same preparation as for rape. They should be sown in drills 2 feet apart, and thinned to about 9 or 12 inches in the drills. They yield heavily, and possess the advantage of being easily stored for late winter use.

Carrots.—A sowing should be made upon deeply-worked soil. They are greatly relished by horses.

The late potato and other crops should be kept free from weeds, and thoroughly cultivated.

The land intended for the reception of lucerne and other perennial crops should be attended to and kept free from weeds.

The ploughing for the main cereal crops should be pushed along, in order to be in readiness for the early sowings.

Orchard Notes.

W. J. ALLEN.

February.

Drying operations will be in full swing this month wherever sultanas, raisin grapes, currants, peaches, and early varieties of prunes are grown. I am pleased to say that at our Wagga orchard all of the above-named fruits are bearing well this year, and we hope to turn out some of the best samples we have had for years.

The raisin grape, sultana and prune, all require to be dipped as soon as possible after picking, and before they have been spread on the trays to dry. They should be immersed in a lye made with one pound of caustic soda to ten gallons of water, when the solution is at boiling point, and allowed to remain in this from one to three seconds, according to the toughness of the skin, as fruit grown on some soils (particularly those of a heavy nature) have thicker and tougher skins than those grown under more favourable conditions, and in consequence, are somewhat harder to crack—therefore, fruits grown in the latter soils may have to be immersed for only one second, while those grown in the heavier soils may require two, or even three seconds to have the same effect. All that is required is to produce minute cracks in the skin, which hastens the drying process, but the operator must avoid too long a dip as it will damage the fruit by cracking the skin too much, and also he must keep the lye as near the boiling point as possible.

As soon as the fruit is dipped it should be spread on trays and put out in the sun to dry as soon as possible. It must not be allowed to dry too much before being removed from the trays. It should be quite tough and pliable, and under no circumstances should it be dry enough to rattle. On the other hand, it should be so dry that if squeezed between the thumb and finger no moisture will exude from it. I might say that this State imports annually from California and other countries large quantities of both cooking and dessert prunes which are in no way superior to those grown here; in fact, all those who sample the dessert prunes put up at our Wagga orchard claim that they can never buy such fruit in the stores. It is, therefore, our intention this year to put up one or two tons of this class of fruit in two-pound glass bottles, so that the public may be able to secure them in either small or large quantities, and I would ask those who buy them to compare them with the best imported article, when they will be able to judge for themselves if what I say is not right, viz., that the Australian prunes are superior to the imported. This does not apply to prunes alone, as I am satisfied that our sultanas, currants and dried apricots are second to none produced in any country in the world, yet we have only begun to think of growing these fruits, and are still importing large quantities from other states and countries.

I would like if more of those interested in this work could find time to visit our Wagga orchard during the drying season, in order to see for themselves how the work is done and the quality of the fruit which we are turning out.

It will be well this month to keep a close watch over all kinds of trees, and wherever scale of any kind is found use every effort to destroy same, either by fumigating or spraying, using any one of the many mixtures which have been found by previous experience to do the best work. For the destruction of San José scale on deciduous trees there is no better spray for this season of the year than the resin and soda wash, and for citrus trees fumigation is the easiest means of ridding the trees of all scales, but wherever brown scale or white louse are found on the trees it is best to increase by one fourth the strength of the charge as given in the fumigating table which I prepared some time ago.

I would again warn growers who practise fumigation not to treat the trees on hot days, but to do the work on cool days, at night or in the early mornings and evenings. In measuring the size of the tree take the extreme height and width before referring to the table to ascertain the quantities of chemicals to use, and be sure not to add the cyanide to the mixture until after the sulphuric acid and water have been put in the bowl or generator, and the latter placed under the tent, then drop in the cyanide and close the tent immediately. Great care must also be exercised not to allow any of the sulphuric acid to come in contact with either the hands or clothing, as it will make the hands very sore, and if it touches the clothing or tents it will burn holes in them.

Keep the cultivator at work this month, and in this way keep down all weeds, as also the land in a fine state of tilth.

The early part of the present month is the best time to bud to better varieties all poor and worthless varieties of fruit trees found growing in the orchard. Do not allow an unprofitable tree to remain there another year. Be sure that the buds used are taken from trees which have borne the very best quality of fruit, and do not forget that, in the case of peaches, the good canning varieties always find a ready sale at good prices.

Continue fighting the codlin moth by picking up and destroying all fruit found underneath the trees and seen to be infested with the moth; and give regular attention to the bandages.

In districts where irrigation is practised, deciduous trees will require their last watering, but grapes intended for raisin-making should not have water applied immediately before picking, as this delays the ripening, and is likely to make them more watery, and, as a result, they take longer in drying, and the chances are that the quality of the dried product will not be so good. The last watering of a vineyard should not take place later than the first of this month.

Arrangements should be made towards the end of the month for sowing leguminous crops, such as are required for green manuring, and as the fall and winter are the only seasons when such crops can be grown among the trees without robbing them of moisture, it is best

to sow only such varieties as will make a fair growth during the cooler and cold months. Such crops as crimson clover, tares, &c., are depended on to furnish nitrogen and organic matter to keep the soil in a high state of fertility.

Condensed Grape Juice.

A vigneron in the Tamworth District has addressed the following inquiry to the Department: "I wish to make a quantity of jeropiga (condensed grape juice) next vintage for sweetening ports and sherries and shall feel much obliged if you will kindly give me some advice on the matter. I propose to use the copper boiler of my still in which I will place the grape must and heat it to boiling point by means of steam circulated through a copper coil immersed in the liquid. I believe steam will be better than heating directly by a fire under the boiler, as there will thus be no danger of imparting a burnt or cooked taste to the jeropiga. It seems to me that the same apparatus will be useful for pasteurising wine. I would then keep the boiler full of boiling water and run the wine through the coil in the boiler and on through another coil surrounded by cold water. Do you think the copper coil should be tinned? Please let me know if you think my plan likely to be successful and any further suggestions you can make will be esteemed."

The Viticultural Expert, Mr. M. Blunno reports:—"The plan suggested for concentrating grape juice is a suitable one. The boiler of the still may be used for the purpose, heated by steam driven through a coil. To expedite the work it would be well for the surface of the boiler to be as large as possible, so that evaporation may be hastened, also that the juice shall be in rather shallow layers and that the steam coil should have a large development in order to increase the heating surface as well as being stout enough to withstand 28 to 42 lb. pressure. The must while being concentrated will form a good deal of froth which is to be skimmed off, and when the liquid is reduced to about one third of its previous volume the heating is stopped.

"I do not think the same arrangement will answer for pasteurising wine; the temperature would never be the same throughout the bulk, being higher than would be required in close proximity to the steam pipe, and there the wine would contract an after-taste and might be below pasteurising point in any portion of the bulk further removed from the steam coil. The insuperable difficulty of regulating the temperature and keeping the whole bulk just at pasteurising degree and the fact that the heating by such an arrangement would be done in the presence of air makes this system, which otherwise would be quite simple and economic, quite unsuitable. I know of a vigneron who set up the same appliance, but had soon to give it up, as his sweet wines that had been put through it, would ferment just the same."

Practical Vegetable and Flower Growing.

W. S. CAMPBELL.

Directions for the Month of February.

Vegetables.

February is generally one of the hottest months of the year, with sometimes blazing hot winds, and sometimes moist, steamy weather, favourable for the growth of many kinds of vegetables, as well as other plants. The chances are that the latter kind of weather will prevail until March, when autumn generally begins. All seasonable vegetables should succeed satisfactorily, for the soil should be in a first-class condition for sowing and planting.

It will be desirable now to look ahead a little, even to late autumn and winter, and arrange operations for the future. This will save a great deal of time and muddling. With a little practice in your particular locality, it will not be difficult to discover the length of time each kind of vegetable should take, under the ordinary conditions, to attain its perfection, or when it should be gathered for use, or when it has finished producing its seeds, such as the pea or bean. A rough idea will do, so as to enable you to be prepared for clearing away all useless stock, and replanting or resowing something else. If plants such as the cabbage, cauliflower, Brussels sprouts, savoys, or broccoli are badly sown and improperly treated afterwards, you will probably find that there is no regularity in their arriving at maturity. Be advised, and carry out the smallest operation methodically. Sow your seeds thinly; prick out the young plants to enable them to gain strength and grow stocky, then plant out all those of the same size in one bed, then the chances are that these will be all ready for use fairly well about the same time. But a family does not want to demolish a large bed of cabbages or cauliflowers within a day or two, therefore you should regulate sowing and planting in such a manner that a continuous supply be kept going in such quantity as may be required.

Beans.—All kinds of beans, except the broad or Windsor bean, may be sown as extensively as may be required, and all old beans which are no longer bearing should be removed, and some other kinds of vegetable sown or planted in their places. Mr. Dunnicliffe tells me that he is inclined to think that the new climbing French bean called Carter's Ten-weeks is likely to prove well worth growing. He finds that it grows about 4 feet high, and is very productive. The bean pods are very fine and tender. It is worth a trial.

Beet (Red).—Sow a few rows of this vegetable, which is so good that no one with a vegetable garden should be without it. The globe varieties are the best kinds to grow, and are likely to keep their shapes better than the long-rooted kinds. Sow the seed in drills about 18 inches apart. As the seed generally takes a long time to

germinate, or "come up," it had better be soaked in water for a few hours before sowing; and then the ground had better be watered well after sowing, that is if it be dry. If nice and moist, you need not bother about the watering. Should the seeds come up thick, thin out the plants well so as to give them plenty of room to grow. Use a hoe of some kind pretty freely amongst the beets, and they should grow well and speedily.

Beet (Silver), sometimes known as spinach, is a fine vegetable, and a most useful one for summer use. The seed may be sown in a seed bed, and the young beets planted out when they are large enough to shift; or it may be sown in drills like the red beet, if preferred. The soil should be made rich with good manure for this vegetable, and if some liquid manure be supplied during its growth occasionally, if it does not seem to be growing as it should, it is likely to be much improved.

Kale, known also as *Borecole*, is a good and useful vegetable, which will sometimes succeed well where its relative the cabbage will not do nearly so well. It prefers cold climates to warm and dry, and if it be just touched with frost it will be improved for the table. It is not often grown here, but it deserves a trial. Like all the cabbage tribe, it is a gross feeder, and needs good soil, or abundance of manure, if it be desired to grow it to perfection.

Cabbage.—There should be sufficient young cabbages on hand for successive plantings during the month—a few at a time. This successive method is a perpetual motion sort of business. Once get it in order it is easy to manage. It has a parallel in Mr. Ellis' duck farm at Botany, where ducks are always laying, eggs always hatching, birds always maturing and always being sold off. Sow a little seed; plant pricked-out plants which are large enough to a heavily manured bed. Take plenty of physical exercise with some sort of a hoe amongst the cabbages, and the plants will probably attain great perfection. The best hoe to use for a small garden is a medium-sized Dutch hoe kept in good order. For a good-sized garden obtain a Planet farm hoe, which is an extremely useful implement, for with its various attachments all sorts of operations can be carried out at a minimum of labour.

Cauliflower and *Broccoli* can be treated in much the same way as cabbage. Both are great feeders, and need good manure in abundance, and they should be grown without any check whatever. It is worth while taking some extra care with these vegetables, for they will well repay it. Sow seed of both, but not too much at a time.

Celery.—Sow a very little seed in a pot, seed-pan, or box. A kerosene tin will serve the purpose just as well, if not better, but some holes should be made in the bottom, so as to allow surplus water to drain away. Seedlings should be pricked out like cabbages for transplanting when they have grown to a height of 6 inches or so, or they may be moved when very much larger; but a good many of the roots and leaves should be trimmed off before planting. Earth up well-grown plants, taking care not to allow any soil or dirt to fall in

between the leaf stalks. Use liquid manure occasionally, and plenty of water if the soil is at all dry.

Cucumbers, Pumpkins, Melons, Squashes, Marrows may be sown if a further supply of these kinds of vegetables are needed; but the sowing had better be taken in hand as early in the month as possible.

Tomatoes, Egg-plants, Okra, and *Capsicum* seeds also may be sown if supplies are required. These seeds had better be sown without delay.

Mustard and Cress.—Sow, now and then during the month, a little seed of these useful salad plants. If dry weather should set in the plants should be watered frequently, and some liquid manure should be given them occasionally.

Leek.—Plant out a few, if any young leeks are ready to shift. Feed all growing leeks liberally, for they are greedy feeders and need abundance of water if the soil be at all dry. Sow a little seed.

Lettuce.—Sow a few short rows from time to time in beds where the lettuces are to grow, for it is better not to transplant lettuce during the summer, for then they have greater tendency to run to seed than if grown without a shift. Manure well, water well if dry, and keep clear of weeds.

Maize—Sweet.—A few seeds may be sown if any more of this vegetable is required, but it is probably too late to sow anywhere except about the coast.

Onions.—Sow a little seed, and cultivate well any young onions that are coming on. Any that are ready for digging—that is, when the leaves have withered up—should be taken up carefully and dried in a shady place and not in the sun.

Potatoes.—Plant a few rows during the month. Take care that the sets are free from scab and potato-moth. Use plenty of manure for the potato unless the soil is rich naturally, when manure may not be needed at all.

Radish.—Sow a little seed occasionally during the month, and make use of the radishes whilst they are young and tender.

Rhubarb.—Those who would care to raise rhubarb plants from seed can do so this month. The plants raised now will be ready for putting out in the early spring.

Sweet Potatoes should be growing well now if kept free from weeds. In warm localities rooted cuttings may be planted, if desired, with good prospects of a successful crop. See that the drainage is good.

Spinach.—Sow a little seed.

Turnip.—Sow a little seed in drills.

Flowers.

As autumn approaches arrangements should be made for the planting of cuttings of roses and other garden plants. Preparation of ground for them could be made at any time now, for there is but little to do in the flower-garden during the month beyond keeping down weeds, cutting grass, trimming hedges and so on, and making things tidy generally.

Bulbs of spring flowering kinds such as daffodils, ixias, &c., may be planted at any time during the month, or even later if necessary.

General Notes.

The Production of Varieties of Wheat with Short Straw.

A Barraba correspondent of the *Daily Telegraph* writes:—A question of vital importance to farming districts, such as this, is the production of a variety of wheat with a short stalk. In good seasons, especially, the wind (whirl-winds principally) knocks down and destroys great quantities of heavy-eared wheat. Could not this loss be minimised by a modification of the habits of growth—say by using fully developed seed from very dry localities with a view to reducing the length of the stalk? Has any systematic experiment been carried out on the lines indicated?

Concerning this subject, Mr. W. Farrer, Wheat Experimentalist to the Department, reports:—

"Except as regards the result which is mentioned as being likely to follow from the use of "fully developed seed from very dry localities with a view to reduce the length of the stalk," the suggestion contained in this letter is a valuable one. I have recognized the superior (in most respects) value of short straw ever since I began my work with wheats, and started it with the aim to make the straw short. I found no difficulty in doing so. In this aim I had two special reasons. The first is that if a plant only produces short straw, it is likely on that account to have more energy left for the production of grain. This is what appears to be the case with many fruit trees, in which a meagre production of wood is often accompanied by high fruitfulness. Another reason is that I am aiming to make strong-flour varieties which are early enough to be suitable for our climate, for the lateness of the so-called Manitoba wheats (Fifes and blue straws) deprives them of all practical value for our interior. As the strong-flour Indian varieties all have very weak straw, I thought that by crossing them into Manitoba varieties and selecting for shortness of straw, I could make varieties which were able in spite of their straw being deficient in shortness, to support heads of good size when they were filled with grain. The variety "Yandilla" was the outcome of those efforts and shows that this is the case; but the shortness of its straw so shocked the manager of the Wagga Farm, that he made a formal protest against the introduction of this variety. This circumstance caused me to see that farmers would need to be educated up to an appreciation of the value of short straw, and I refrained from putting "Yandilla" and some other short-straw varieties into general cultivation. Other varieties which fulfil the condition of having straw which is short enough to enable them to withstand high winds, are Federation (especially certain strains of this variety) and another

variety to which I have given the suggestive name of "Pygmy." All these short-straw varieties appear to be very productive, and not improbably are so on account of the shortness of their straw. Federation is undoubtedly, in certain localities at any rate, exceedingly productive. This has been proved to be the case in some comparative trials of varieties, which were made in the years 1901 and 1902, by Mr. Coleman of Saddleworth, S.A., in which this variety headed the list for productiveness in both years. The results of both these trials are published in the *Journal of Agriculture, &c.*, of that State. The objection, however, that wheats which have short straw are unsuitable for hay and that it is desirable to have the resource of making the crop into hay, if dry weather should occur at the critical time when the grain is filling, prevents short-straw wheats from being widely adopted; but apart from hay-making purposes, short straw is better than long for every other reason, facility of stripping included."

Cape Barley.

Mr. A. D. Griffiths of Leamia, Curlewis, furnishes the following report on a small area of Cape Barley.

The area comprised three acres of red (or chocolate) soil, stoney on surface, and about two feet in depth over a loose clay and limestone subsoil. It was ploughed for the first time in May this year, the ground being broken up with a small orchard plough to a depth of six inches where practicable, but owing to the hard nature of the virgin ground and the presence of a considerable quantity of stones, the depth in places was reduced to about three inches, while odd patches were barely scratched. The greater part, however, say two acres, was fairly well ploughed.

The seed was sown at the rate of 1¼ bushel per acre with a broadcaster—one acre on the 11th and two acres on the 20th May—and harrowed in with a light lever harrow. All the stones showing on the surface was collected and carted away and the ground rolled on 21st July, when the barley was a few inches high. The crop received no further cultivation.

I had put it in with the intention of cutting it for green feed, but as herbage was abundant throughout the winter and spring, I had no occasion to cut the barley and let it run to seed, which I harvested with a stripper and winnower on 9th November. The result was 50 bags which would have been considerably added to had not heavy rains and hailstones, on 26th October and 2nd November, knocked a lot of the barley down, large patches of heavily-seeded stalks being flat on the ground out of reach of the stripper. Taking these patches as a whole I should say that almost if not quite an acre was lost. Setting the lost grain down at the very low estimate of 10 bags, this shows an 80-bushel yield, but I am inclined to believe that had all the grain been saved the crop would have yielded 100 bushels to the acre. The crop rippened somewhat unevenly—owing probably to the irregular ploughing of the ground previously referred to, and also to broadcast sowing causing the seed to be lodged unevenly as regards

depth of covering. Some of the grain was rather on the green side when stripped, causing a further loss in the winnowing through a considerable quantity of grain passing away with the chaff, but owing to the unsettled state of the weather and consequent risks attached to any further delay, I took the earliest opportunity of harvesting.

The following is the rainfall as recorded here from date of sowing to harvesting :—

		Points.			Points.			Points.
May	6	7	Aug.	2	14	Oct.	5	11
,,	7	34	,,	3	1	,,	6	30
,,	8	162	,,	7	2	,,	14	8
,,	9	98	,,	25	13	,,	15	108
,,	17	11	,,	26	161	,,	16	9
,,	21	59	,,	27	11	,,	23	50
,,	22	11	Sept	1	46	,,	24	7
June	8	19	,,	2	7	,,	27	54
,,	13	3	,,	17	150	,,	28	6
July	9	10	,,	18	84	Nov.	3	74
,,	10	14	,,	19	21	,,	4	12
,,	14	52	,,	20	5	,,	5	5
,,	15	14	,,	26	41	,,	8	3
,,	25	47	,,	27	10			
,,	28	2	,,	28	5	Total rainfall 15·09 in.		
Aug.	1	4	,,	30	14			

Destruction of Plague Locusts.

Mr. W. H. Sutton writing to the *Entomologist* from Everdon, Howich, Natal, says :—"From paragraphs I have noticed in Australian papers it appears that you are now battling with either grasshoppers or locusts to a serious extent. We have been through the same experience here, during the last seven or eight years, with the result that the insects have been greatly reduced in number by means of arsenical poison applied to patches of crop or vegetation, in places likely to be infested with the pest. Fungus was tried for a time, but was found to be too uncertain in dry weather, though in many cases it acted very well. The arsenic solution (1 lb. arsenic, 1 lb. caustic soda, 4 gallons boiling water : dissolve soda in the water at boiling-point, add arsenic and stir for a few minutes, taking care to avoid fumes which are poisonous. Spray ½ gallon poison in 4 gallons cold water over green stuff) has been used all over the country where young locusts have been found—on cane, on mealies (maize), grass, &c.,—without any ill effects to cattle or other animals. I believe that fowls have even been known to eat the locusts which have died of arsenical poisoning, without taking any harm. I cannot, however, vouch for the last statement. I do know that my neighbours have used the preparation on grass land, and have had no bother about their cattle afterwards, on the same land. It is poisonous to the grass and kills it, so there is less risk of the cattle after a few days eating any of the vegetation to which the poisonous mixture has been applied. The grass, as a rule, may be readily burnt in a few days after spraying, thus doing away with all danger. I hope you will try this remedy and have the same good results that have been obtained in Natal."

In connection with this interesting communication, Mr. Froggatt points out that he has made experiments with the arsenical poison referred to, but the difficulty met with has been the fear of poisoning stock on the areas containing crops of vegetation treated with such sprays. He advocates, as a safer and equally effective remedy, the laying of poison baits, as suggested, where due precautions can be taken, and rigidly observed.

Mr. Froggatt suggests the burning-off of grass, when the grasshoppers first emerge from the ground, in dry districts where the conditions are somewhat similiar to those of Natal. Readers of the *Gazette* are no doubt quite familiar with the African fungus remedy, full reports as to results of experiments with which have appeared in the *Gazette*. Mr. Froggatt found that the difficulties in the way of successful use of the fungus in dry districts, such as Condobolin, were the same as those in South Africa.

Crossbred Wheats tried at Manilla, N.S.W.

Mr. D. E. Veness, of Manilla, writes: "Two years since I made application to the Hawkesbury Agricultural College for some samples of seed wheat for trial here, and received small quantities of four varieties. In consequence of the terrible drought, I was unable to make use of them then; but this year we planted them, and, thinking you would like to hear something of their growth and produce, I have noted down a few particulars respecting them, which I trust may be of interest:—

"*Bobs*.—Sown 30th June, gathered 23rd December, 1903; fine straw; grew 5 feet in height; stood up well through a moist growing season; both straw and grain unaffected by rust, though standing in the centre of a paddock of wheat rather badly affected with rust; very good sample of grain, estimated to yield 30 bushels per acre.

"*Jonathan*.—Sown and gathered same dates as Bobs, and grown in same situation; fine straw, all laid down, too weak to stand; grew 5 feet in height; fair grain, yield about 16 bushels per acre; no rust on grain or straw.

"*Federation*.—Sown and gathered same dates as Bobs, and in same situation; strong straw, about 3 ft. 6 in. in height; stood up well; straw rusty, fairly good and clean grain; yield, about 20 bushels per acre."

Mr. Veness also received for trial a packet of Manitoba wheat, concerning which he reports:—"Fine straw; grew 4 feet in height; small dark grain; yield about 16 bushels per acre; no rust on straw or grain. This was sown and harvested on the same dates as the other three."

AGRICULTURAL SOCIETIES' SHOWS, 1904.

Society.	Secretary.	Date.
Dapto A. and H. Society ... .. (Acting Secretary)	W. E. Faulkner...	Jan. 13, 14
Albion Park A., H., and I. Association	H. Fryer... ...	,, 20, 21
Gosford A. and H. Association	W. McIntyre ...	,, 22, 23
Kiama A. Association	J. Somerville ...	,, 26, 27
Wollongong A. and P. Society	J. A. Beatson ...	,, 28, 29, 30
Luddenham A. Society	J. M. Blake ..	Feb. 9, 10
Moruya A. and P. Society	J. Jeffery ...	,, 10, 11
Manning River A. and H. Association (Taree) ...	S. Whitbread ...	,, 11, 12
Ulladulla A. and H. Association	Jos. Kendall ...	,, 17, 18
Pambula A., H., and P. Society...	J. B. Wilkins ...	,, 17, 18
Alstonville A. Society	F. H. Bartlett ...	,, 23, 24
Candelo A. Association	C. A. Brooks ...	,, 24, 25
Tumut A. and P. Association	Bland Clayton ...	,, 24, 25
Lithgow A., H., and P. Society...	H. N. Tolliffe ...	,, 24, 25
Campbelltown A., H., and I. Society	A. R. Payten ...	Mar. 1, 2
Tenterfield Intercolonial P., A., and M. Society ..	F. W. Hoskin	,, 1, 2, 3
Bega A., P., and H. Society	John Underhil ...	,, 2, 3
Lismore A. and I. Society	T. M. Hewitt ...	,, 2, 3
Newcastle and District A., H., and I. Association ...	M. A. Fraser ...	,, 2, 3, 4, 5
Robertson A. and H. Society	R. G. Ferguson ...	,, 3, 4
Port Macquarie and Hastings Dist. A. and H. Society	J. Y. Butler ...	,, 3, 4
Castle Hill and District A. and H. Association ...	R. H. Lalor ...	,, 8, 9
Glen Innes and Central New England P. and A. Association	Geo. A. Priest ...	,, 8, 9, 10
Bombala Exhibition Society	R. H. Cook ...	,, 9, 10
Tumberumba and Upper Murray P. and A. Society ..	Jack J. McAlister	,, 9, 10
Crookwell A., P., and H. Society	C. T. Clifton ...	,, 11, 12
Cobargo A., P., and H. Society...	T. Kennelly ...	,, 16, 17
Clarence P. and A. Society	Jas. C. Wilcox ...	,, 16, 17
Blayney A. and P. Association	H. R. Woolley ...	,, 16, 17
Camden A., H., and I. Society	C. A. Thompson	,, 16, 17, 18
Goulburn A., P., and H. Society	J. J. Roberts ...	,, 17, 18, 19
Gundagai P. and P. Society	A. Elworthy ...	,, 22, 23
Lower Clarence (Maclean) A. Society	Geo. Davis ...	,, 22, 23
Mudgee A. Society	J. M. Cox ...	,, 22, 23, 24
Upper Hunter P. and A. Association (Muswellbrook)...	Pierce Healy ...	,, 23, 24, 25
Warialda P. and A. Society	W. O. Geddes ..	,, 23, 24
Cooma P. and A. Association	C. J. Walmsley ...	,, 23, 24
Liverpool Plains (Tamworth)	J. R. Wood ..	,, 23, 24
Cumnock P., A., and H. Society	W. L. Ross ...	,, 23
Macleay A., H., and I. Association	E. Weeks ...	,, 23, 24, 25
Nepean District (Penrith) A., H., and I. Society ...	E. K. Waldron...	,, 24, 25
Quirindi District P., A., and H. Association	Geo. Haughton ...	,, 27, 28
Molong P. and A. Association	C. J. V. Leathem	,, 30
Royal A. Society	F. Webster	Mar. 30 to April 7
Bathurst A., H., and P. Society	W. G. Thompson	Ap. 13, 14, 15, 16
Richmond River A., H., and P. Society.	E. J. Robinson ...	,, 14, 15
Hunter River (West Maitland) A. & H. Association...	W. C. Quinton	,, 19, 20, 21, 22
Orange A. and P. Association	W. Tanner ...	,, 20, 21, 22
Upper Manning A. and H. Association..	W. Dimond	,, 28, 29
Moree P. and A. Society	S. L. Cohen ...	May 3, 4, 5
Dungog A. and H. Society	Chas. E. Grant ...	,, 4, 5
Coonamble P. and A. Association	F. C. Lamotte ...	,, 11, 12
Cobar P. and A. Association	J. M. Scott .	,, 25, 26
New South Wales Sheepbreeders' Association... ...	A. H. Prince ...	June 29, 30; July 1, 2
Grenfell P. and A. Association	Geo. Cousins ...	Aug. 25, 26
Temora P., A., H., and I. Association	W. H. Tubman...	Sept. 13, 14

[5 plates.]

Agricultural Gazette of New South Wales.

Saltbushes, their Conservation and Cultivation.

R. W. PEACOCK.

After considerable experience and advocacy of these valuable native plants, I wish again to draw the attention of the western pastoralists to what, in my opinion, is one of the most important questions relating to the management of that vast area of western New South Wales, which lies beyond the zone of rainfall in which grasses and allied fodder plants can be reasonably relied upon to yield the necessary amount of sustenance in ordinary seasons.

The experience gained during the last few years has not led me to advocate the cultivation of saltbushes in areas where perhaps better fodder plants can be more easily cultivated to make provision for time

Fig. 1.—A 50-acre paddock of mixed Saltbushes at Coolabah Experimental Farm.

of drought, but has more than convinced me of the value of these plants and the practicability of cultivating them largely and profitably upon the majority of holdings in the arid regions.

It may be claimed that the present is inopportune to advocate the expenditure of any money upon the cultivation of plants when the native grasses and herbage are in such profusion. One of the most important lessons that the past drought has taught is that the grass and herbage are not to be relied upon for any considerable time. Also, the value of saltbushes has been fully appreciated upon all the holdings fortunate enough to possess them.

Another fact that should be ever present with us is that droughts will again recur, and the waving plains and overflowing gilgais of to-day will give place to the dull grey and chocolate of the wind-swept plains and muddy waterholes.

Such reflections should spur us to some effort to make provision as an insurance against the risks of the future. Provision should be made during good seasons such as the present.

There are no plants that offer greater possibilities in this direction than the saltbushes. Their drought-resistance enables them to flourish long after the herbage and grasses have disappeared. Holdings possessing saltbushes can carry stock during drought considerably longer than country on which they have been eaten out.

The protection afforded the soil by them against the excessive winds is considerable, thus preventing the baring of the surface. They form

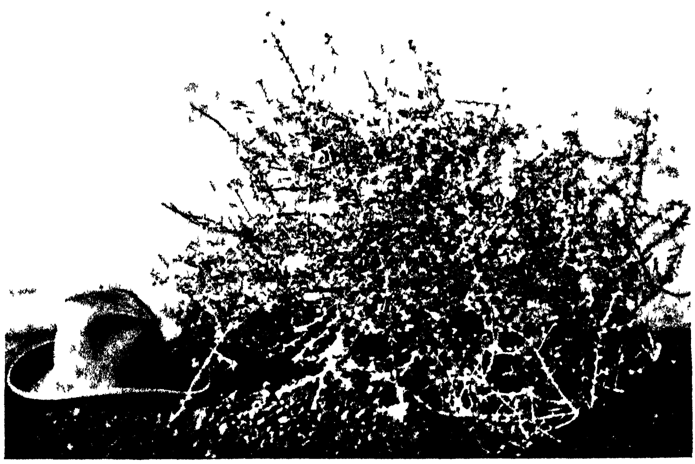


Fig 2 *Bassia bi rpi*

a lodgment for transported vegetable matter and seeds, and prevent the excessive heating of the surface by the sun. Their cultivation and conservation is particularly desirable upon areas which have been denuded of their timber by ringbarking. Upon such areas when bared by droughts, deterioration would be retarded considerably by the fostering of saltbushes.

Their cultivation in suitable positions to allow of their dissemination by natural agencies would add materially to the carrying capacity of the holdings during drought.

There are almost one hundred saltbushes and herbs indigenous to the arid districts, and the best of these have been collected and cultivated at the Coolabah Experimental Farm. Many are not worthy of attention as fodder plants, as they possess spines which prevent stock from eating them, excepting in their very young stages. Such, however, are enabled to resist the heavy stocking, and protect the

surface and pave the way for more profitable growths, if such are given an opportunity.

One of the most important of these in this respect is *Bassia bicornis*, F. v. M., fig. 2.

In the forefront of those worthy of cultivation I place the old man, *Atriplex nummularia*, Lindl., fig. 3.

Fig. 3.—Old Man Saltbush, *Atriplex nummularia*.

A paddock of this variety at Coolabah remained green throughout the severest of the drought.

Plantations placed at intervals throughout a holding would produce seed sufficient to ensure a large proportion of plants over a considerable area, the seed being disseminated by natural agencies. With a little trouble man could aid this distribution by collecting and distributing the seeds in suitable places. Some varieties possess seeds with envelopes well calculated to ensure their dissemination by winds, such as *Atriplex halimoides* and *Atriplex vesicaria*. Others, such as the foregoing and *A. angulata* and *A. semibaccata*, must rely more upon transportation by birds and animals.

The "old man" grows to the height of about 10 feet, which places it beyond the reach of sheep, and it is therefore not so easily eaten out. It provides shelter for animals, an abundance of seed easily gathered, and a large amount of fodder in a short period. Its protective influence upon the soil is considerable. The best method of propagation for the West is from seed, which germinates readily under favourable conditions. It is noticeable that many seeds do not germinate at once, even under favourable conditions, and reserves are apparently held over for future germinations.

This provision of nature prevents the destruction of all the seeds by sprouting after conditions favourable to germination, but not to the after development of the plant. It is reasonable to suppose that saltbush seeds retain their vitality in the soil for a considerable number of years, especially under the dry conditions prevailing during droughts.

It is wise, owing to the above reasons, to sow a fair proportion of seeds to ensure a fair percentage of plants; also, a proportion of the seeds are probably infertile. The seeds should be covered lightly no deeper than 1 inch below the surface to ensure the best results. Other methods of propagation are by cuttings and layers, but cannot be recommended for the western conditions. The best time to sow the seed is during the autumn or spring, or in summer if favourable conditions can be relied upon. If cuttings are attempted, the autumn would be the best time to set them out. The system of layering would hardly be practicable in large areas, but is a natural means

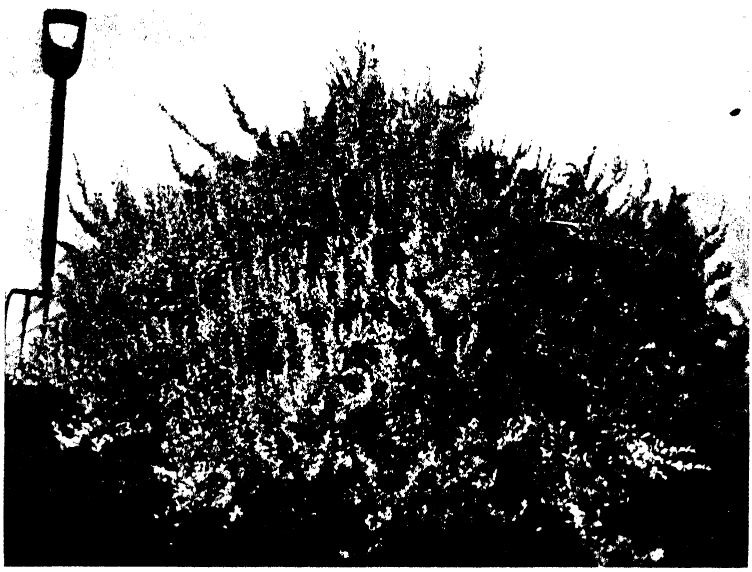


Fig. 4.—*Atriplex vesicaria.*

of enlargement. The procumbent branches put forth roots readily under moist conditions, resulting, in some instances, in very large spreading bushes.

Bladder saltbush (*Atriplex vesicaria*, Heward), is sometimes called "plain saltbush," on account of its appearing most abundantly upon the plains. It grows to the height of about 3 feet, and is rather a woody shrub, producing an abundance of seed, which are small, with a large bladder-like covering, greatly facilitating distribution. It is much relished by stock, and, not growing to any great height, is rapidly destroyed by overstocking; its binding and protective effects upon the plains are most advantageous, and it is one of those worthy

of considerable attention. The seed is easily collected, and germinates readily under favourable conditions.

Atriplex halimoides, Lindl., is an annual under-shrub, and is often termed dwarf saltbush, growing from 1 to 2 feet high. It grows

Fig. 5.—*Atriplex halimoides.*

rapidly, and produces large quantities of seed, in many respects similar to *A. vesicaria*. When once established, seedlings spring up the

Fig. 6.—*Atriplex angulata* (species).

following season in places far distant from the parent bushes, in situations capable of retaining the seeds and favourable to germination. It is relished by stock, but is rapidly exterminated by continuous

overstocking. Its annual habit of growth discounts its value for lengthened periods of drought, but upon the return of favourable conditions it affords a considerable amount of succulent herbage in a short time, and under conditions unfavourable to many other plants.

Atriplex angulata, species.—This is a very hardy shrub, and has been cultivated under this name at the Coolabah Farm; it is not synonymous with the *Atriplex angulata* of Bentham, which is more procumbent and herbaceous. It grows to the height of from 2 to 3 feet; it is easily cultivated, and extremely drought-resistant.

Half-berried saltbush (*Atriplex semibaccata*, R. Br.) is a valuable plant with a procumbent habit, and is sometimes called "creeping saltbush." It is one which has been long recognised as of great importance for many purposes. Its spreading stems and leaves afford valuable protection to the soil and also to itself. It produces an abundance of seed, which germinates readily if covered very lightly,

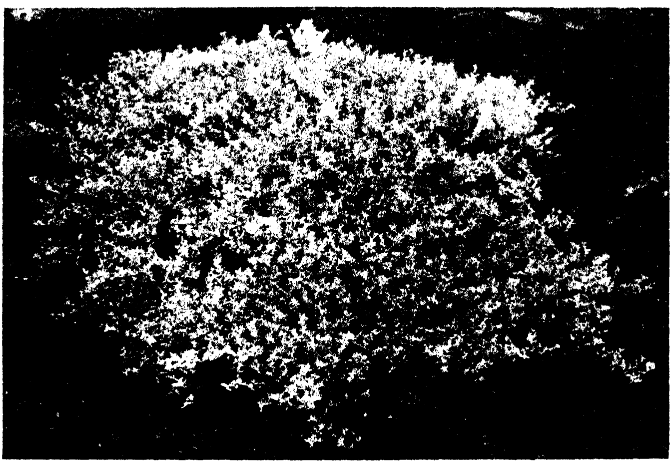


Fig. 7.—*Atriplex semibaccata.*

and under favourable conditions without any covering. The seed is somewhat succulent, and care should be taken whilst gathering to allow of its drying, or otherwise it would spoil, which fact probably accounts for the low percentage of seeds germinating in many instances. The same applies to a number of saltbushes.

Atriplex stipitata, Benth., is a stalky, somewhat sparsely-leaved variety; it possesses the advantages of being exceptionally hardy and easily cultivated. It grows to the height of about 3 feet, and is a good fodder.

Atriplex leptocarpa, F. v. M., has a somewhat variable habit of growth, in some situations being prostrate as *A. semibaccata*, and in others more ascending. It produces an abundance of seed under most adverse conditions, but the foliage is not so abundant as in *A. semibaccata*.

Of the different families of saltbushes *Atriplex* contributes by far the most important for purposes of cultivation. Of the genus *Rhagodia*

there are a few important ones, but, generally speaking, their seeds are not easily collected, and care must be exercised in the thorough drying of the fruits.

Rhagodia parabolica shares with *Atriplex nummularia* the name of "old-man saltbush," but at present the latter is more generally recognised as the "old man." I have not yet come across a specimen of *Rhagodia parabolica*, and conclude that it is well-nigh extinct in many places.

Rhagodia hastata, R. Br., hastate-leaved saltbush, is a very handsome shrub, attaining the height of about 4 feet in its natural habitat. It is propagated principally from cuttings, the seeds being difficult to

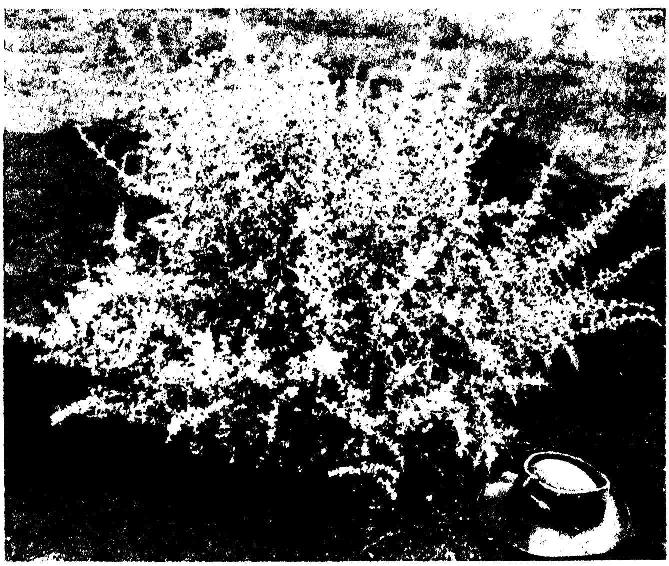


Fig. 8.—*Rhagodia hastata.*

gather in quantity, thus precluding its cultivation by this method in large areas. The conservation of existing bushes is desirable and more practicable. It is this variety which is used largely around Sydney for hedges. It is also valuable as shade and food for poultry. It is very drought-resistant, and thrives upon a diversity of soils.

Nodding Saltbush, *Rhagodia nutans*, R. Br., produces an abundance of small red or yellow succulent fruits, which allows of its cultivation in fairly large areas. It is a valuable fodder plant of a prostrate, herbaceous habit, and would well repay the trouble of cultivation.

Bluebush, *Chenopodium auricomum*, Lindl., is a shrub which grows to the height of about 4 feet, and produces a large quantity of nutritious fodder. It is most plentiful upon the heavier soils and around gilgais, where it is enabled at certain seasons to get a large supply of moisture. When cultivated on drier lands it produces a limited amount of fodder.

This plant, together with *Chenopodium nitrariaceum*, F. v. M., would be very suitable for dissemination upon the heavier soils.

Chenopodium triangulare, R. Br., is a prostrate herbaceous plant, growing profusely upon the lighter red soils, producing a large amount of fodder, which is not so valuable as that of many of the other salt-bushes.

Fig. 9.—Blue Bush.
Chenopodium auricomum.

Barrier Saltbush, *Enchylæna tomentosa*, R. Br., is a much branched shrub, attaining the height of 2 to 3 feet, is much relished by stock,

Fig. 10.—Barrier Saltbush, *Enchylæna tomentosa.*

and produces an abundance of succulent seeds requiring care in the curing. They germinate under very adverse conditions; the plant, also, is remarkably drought-resistant.

Of the family *Kochia,* perhaps the cotton-bush, *Kochia aphylla,* R. Br., is the most widely known. It is very drought-resistant, and in many situations plentiful, its angular habit of growth being efficacious

Fig. 11.—Cotton Bush. *Kochia aphylla.*

in preventing its annihilation by stock. The seeds are not easily collected, and it therefore cannot be considered as very suitable for cul-

Fig. 12.—*Kochia villosa.*

tivation. This also applies to other members of the family, comprising excellent fodder-plants, and the greatest benefit would accrue from their systematic conservation.

Kochia villosa and *Kochia pyramidata* are two of the most valuable. There are other saltbushes of perhaps equal value to many mentioned, but I have been unable to obtain them, and I fear numbers are extinct. Of those enumerated I would strongly recommend to the Western pastoralist the following:—

Atriplex nummularia.
A. vesicaria.
A. semibaccata.
A. angulata spec.
A. stipitata.

Since the drought the saltbushes have not returned in the same profusion as the grasses, and upon many holdings they have been totally destroyed.

Fig. 13.—*Kochia brevifolia.*

After several years experimenting with many fodder plants of reputed drought-resistance from various parts of the world, I am forced to the conclusion that the Australian saltbushes have no rivals in drought-resistance and general adaptability to the conditions under which they were evolved.

In this respect the West must look after its valuable plants, and not ruthlessly destroy those which make it valuable. It should rather jealously watch over that which ages of periodic droughts have handed down, and use every endeavour to conserve the valuable natural plants, and make good in some small measure the mistakes of the past by the cultivation and conservation of the many plants which alone can do much to minimise the risk of pastoral occupation throughout the droughts which must inevitably recur.

Lucerne

W. H. CLARKE.

On several occasions there have appeared in this *Gazette* articles on the cultivation of lucerne in districts like the Hunter, where the soil is all that can be desired, and the rainfall and flooding is, in nine years out of ten, ample for the crop. In such districts, lucerne is generally grown for hay that is marketed, and a comparatively small acreage is used for the production on the farm of milk, pork, beef or mutton. Hay is, no doubt, a very remunerative form of marketing in the case of such districts, because the facilities for transport are good. Perhaps, in time to come, the farmers of the Hunter and similar districts will find that an even more profitable form in which to market their lucerne will be in the shape of milk, pigs, or other live stock. In lucerne paddocks comprised of soil not half so well adapted for the purpose as even the poorest Hunter flats, American farmers breed pigs by the million. They run, as a rule, five or six sows and their litters to the acre of lucerne (more when irrigated), and top them off on Kaffir corn (a non-saccharine sorghum that thrives to perfection throughout New South Wales) or maize. But it is not so much concerning the cultivation of lucerne, and the uses to which it can be put in the coastal and humid districts, that the present article proposes to deal. The desire is to present to those in the districts which are generally regarded as too dry for the successful growth of lucerne, some details as to the methods followed by farmers and pastoralists who have, by dint of experiment, evolved means of growing enormous areas of this valuable plant in dry localities that a few years ago were deemed to be absolutely unsuitable for it. As far as possible, the information has been gathered from places where the soil, climate and natural surroundings are to a great extent similar to those of the districts of New South Wales not blessed with abundant or regular rainfall.

Lucerne without Irrigation.

Mr. W. S. Marshall, of Channing, Hartley County, Texas, thus describes in the *Farm and Ranch* the methods adopted by himself in growing lucerne in the hot, droughty portion of the Texas Plains known as the Panhandle:—" Select a plot that has been in cultivation for a year or more, preferably one that has been well tilled and kept free from weeds. Plough deep in the fall or early winter. I usually follow plough with subsoil plough. Harrow down well every day what you have ploughed. You cannot get the land too well harrowed. Make it fine and free from lumps before you leave it. I have found

May to be the best month for seeding. (That would be equivalent to spring sowing in New South Wales, say, September.) Just before seeding thoroughly harrow the land, using an adjustable harrow with the tines set back at about an angle of 45°. The object is to thoroughly pulverise the top soil to about 1 inch in depth. Do not use a disc, you will stir too deep. This harrowing is important; do it well.

"*Seeding.*—I use a presser-wheel shoe-drill set to sow about 15 lb. per acre. Hook it up so the shoes will not cut over 1 inch in depth. The object is to deposit the seed on the solid damp earth just below that previously made fine by harrowing. If you use the presser-drill in this way 15 lb. per acre of good seed is sufficient. It will all probably sprout and come up even if it should not rain soon. If a drill is not available sow broadcast by hand or with a wheelbarrow grass-seeder, and use 20 to 22 lb. of seed per acre. Follow with the tooth-harrow with the teeth set quite flat. Follow the harrow with a plank or drag to level down the ground and ensure the light covering of the seed. Sown in this manner not all the seed will germinate until after a rain, and some will be covered too deep, hence the need of more seed than where the drill is used. Good lucerne* seed germinates quickly. I have had it show top of ground in forty-eight hours from time of seeding. The seed itself comes to the top of the ground parting like a melon seed, the two halves of the seed forming the first two leaves of the plant. If it is covered deep or by a hard lump it will not push itself to the surface. Our Panhandle soils are apt to crust on top after a hard rain followed by a hot sun or drying winds. Should this happen, it is best to break the crust with a harrow, or, what is better, with a spring-tooth weeder.

Treatment the First Season.—" Clip the young plants with a mower just as often as they get high enough and begin to show bloom. By all means do not let any seed pods develop. Let the cut stuff lie on the ground as a mulch. If there has been a heavy beating rain so that the ground is quite packed, harrow after clipping. Remember, the more lucerne is cut the first season the better it will grow and the sturdier will be the root. Three or four stalks will come in place of each one cut off by the mower, and this increases the size of the crown.

"Do not get discouraged about your lucerne if you do not get much of a crop the second year. It takes about three years to develop a full stand and good crop in these dry lands, where it cannot be irrigated. Have patience to wait, and you will have a crop that will repay your trouble, one that an occasional disking will keep growing better for years.

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*In the United States *Medicago sativa* is called alfalfa, an Arabic name, under which the plant was carried in the early days to South America by the Spaniards. It has been cultivated in Southern Europe for many centuries, but it is only in Spain that the name alfalfa is applied; elsewhere in Europe it is known as lucerne. The latter being the name under which *Medicago sativa* is commonly known in Australia, it has been thought just as well to make the alteration in the American extracts to prevent confusion.—ED.

"Now, about the seed. I have had my best results from seed grown from non-irrigated lucerne. For the dry Panhandle lands, get seed grown in places like Kansas or Nebraska, and from lucerne that has not been irrigated.

"Following above outlined methods, I have never, in six years, scored a failure of getting a stand of lucerne here in the Panhandle."

Another very prominent Texas farmer, Mr. R. E. Smith, of Sherman, also in a drought-liable section of the State, in speaking at meetings of farmers and stock-raisers, placed lucerne at the head of the list of pasture and forage crops. Some of his statements were challenged, and the remarks he makes in explanation cover so many points that are likely to present themselves to New South Wales lucerne-growers that it is thought they are worth reproducing here:—

"The country is seized with lucerne craze; the boom is squarely on. My praise of lucerne cannot benefit me; undue praise will cause over-production, increasing my competition. Notwithstanding the injury that may result to me, I have felt it proper to give to the farmers the benefit of my experience, and to make known to them the value of this splendid plant. The extracts referred to are abundantly explained in my speeches, and, taken in connection with those speeches, are substantially correct. I have repeatedly said that lucerne was the best pasture known to man; that it would feed more stock than any other; that for hogs it was ideal, and without a rival; that it made the finest of hay, of the same succulent effect as green grass; that its tonnage was greater than any other forage plant, and that, too, without the expense of annual re-seeding and ploughing, as it was a perennial; that the soil was greatly enriched and renovated by its growth, rather than impoverished, as in the case of other plants; that my meadows yielded me an average of 4 tons per acre per annum; that it would pasture about twenty head of hogs per acre per annum, and grow them to 200 to 250 pounds each. Let your intelligent readers visit my meadows and see verified each of the foregoing statements."

"'Alfalfa Raiser' (the *nom de plume* of the farmer who challenged Mr. Smith's statements) says he was on my farm in June (equivalent to about November in New South Wales), and in a former article said he slept there, and that he "pumped" the foreman dry. It does not appear that he was over-modest. He does not tell you all that he talked about with the foreman; nor does he make known to you the character of his correspondence with the foreman since he left there. The "foreman" referred to by him was not a foreman. I then had no foreman. One of my renters was, during the month of June, looking after my business as best he could while I was hunting a foreman, and he knew no more about lucerne than a hog does about holiday, and will tell you so if you write him now at my farm, although 'Alfafa Raiser' says he learned from him the methods of planting, cultivating, and harvesting lucerne. At that time there was no hay upon my farm, and the reasons were known to 'Alfalfa Raiser,' though

suppressed by him. Then our country was in the throes of the severest drought known. Up to that time, upon my farm, and in other parts of the county, we had had no rain since the cessation of the floods of winter and spring, and, notwithstanding this severe drought, we had already cut one heavy crop of lucerne. The ground at that time had great cracks and crevices, which he saw; cotton seeds were lying in the ground not sprouted; great tracts of oats were then being ploughed up or grazed down by the stock, because of its worthlessness, and I was then engaged in cultivating, not harvesting, my lucerne, the statement of 'Alfalfa Raiser' to the contrary, notwithstanding. This renter explained this fact to 'Alfalfa Raiser.' We were cultivating the meadows by running our mowers over them and cutting down the short shoots that were shooting up, in spite of the drought, to prevent them from blossoming and seeding, as such is exhaustive to the meadows, and we were following this with heavy harrows to loosen the earth and fill up the cracks that they might be ready to receive the rain and grow. I have often said that lucerne was a drought-resisting, but never have I said it was a drought-growing plant. Since the heavy rain of July I have already cut all of my lucerne once, and have cut some twice, except 400 acres that I saved for seed. It requires double the time for making seed that it does for making hay. Though there was not a ton of lucerne upon my farm when 'Alfalfa Raiser' was there, let him now come and inspect the large sheds and barns and great stacks of hay upon the ground, and then advise his readers what he has seen.

"When I sowed those hills I doubted my experiment. Now, let any man come and see, and profit. There at the same place he may see hills so steep that a waggon can hardly climb them, and bottoms so low that the lucerne stood 5 feet under water on the third day of last July, and he can see all flourishing and growing side by side, and learn that it is truly the hardiest of plants.

"Now, my advice to the farmers is what I have told them at many an agricultural revival—to wit: begin with a small patch; prepare the ground well, as I did; then take my word for it, he will be enlarging it as I have done. In this way he educates himself gradually how to deal with it, and in this way he cannot be hurt, even though he fails. But he will not fail, but will live to thank me and others who advised him to begin cautiously and in a small way."

It will be noticed that both Mr. Marshall and Mr. Smith refer to the use of the disc harrow for treating the crust on the packed soil of established lucerne paddocks. In the *Agricultural Gazette* for May, 1901, there appeared the results of some experiments carried out at the Agricultural Experiment Station, Manhattan, Kansas, by Mr. H. M. Cottrell who had discovered, in quite an unlooked for way, that the disc harrow was a most effective implement for keeping the soil in lucerne pastures in good tilth. The conditions under which Mr. Cottrell's experiments were carried out were very similar to those prevailing in some of the semi-arid districts of New South Wales. For the information of those who have not had an opportunity of perusing the original report, the salient portions of it are now reproduced.

The first experience in discing lucerne was in 1898. A field had been seeded to lucerne in the dry year of 1894 and a poor stand secured. In 1897 this lucerne was heavily pastured by hogs. The hogs were taken off early in the fall and a heavy growth of crab grass came up. The crab grass was so thick, and the stand of lucerne so thin, that it was not worth keeping.

This grass is apparently identical with the grass known in New South Wales coastal districts as summer grass.

Late in March, 1898, this field was harrowed with a disc harrow, the discs sharp and set at as great an angle as possible. It was immediately cross disced with the discs set the same way. The ground was thoroughly pulverised, and the lucerne apparently destroyed. It soon started, branched out thickly, and three good cuttings were made from that field that summer.

In 1900 Mr. Cottrell went a step further in discing lucerne. The season was very dry at Manhattan, the rainfall in June being 1·19 inch, in July 4·51 inches, and in August 2·84 inches. Two fields of lucerne, two years old, were disced.

One field was disced March 28, the first cutting for hay made May 31; disced June 6, the second cutting for hay made June 25; disced June 27, the third cutting made August 13; and the lucerne disced for the fourth time August 20. The last cutting of lucerne was made September 13. This shows four discings and four cuttings of lucerne on upland in a dry year.

Another field of lucerne was disced and cross-disced March 27. The first cutting of lucerne was made June 4 and the second discing June 6. Through July and the early part of August the crop was cut from day to day and fed green to dairy cows to help out dried-up pastures. August 20, the field was disced, and October 3 the last cutting made.

The lucerne in both fields made fine late fall growth, and went into the winter in good condition.

The stand of crop on both fields disced in 1900 was good. A harrow with sharp 16-inch discs was used, the discs being set at a slight angle, just sufficient to turn the soil over, and the harrow was weighted to make the discs split the lucerne crowns to a depth of 2 inches. The discing split the roots, and this made them throw out many new shoots. The discing made an earth mulch over the field, and prevented the evaporation of water, so rapid in a dry time from a lucerne field just after being cut. The discs were set so that they barely turned the soil over, and, running at a depth of 2 inches, they turned the roots of the crab grass and weeds up to the sun, which killed them. These disced fields were clean and free from crab grass in the fall.

In summarising his conclusions, Mr. Cottrell says: "We have not disced one-year old lucerne. From these experiments we feel safe in recommending discing all lucerne of two years or more standing. Make the first discing early in the spring, and then disc immediately after each cutting. If the stand of lucerne is fair to good, set the discs as we did in the experiments made in 1900. If the stand is poor, and the growth of crab grass thick, set the discs to cut deeply. Discing is of as much value to lucerne as cultivation is to corn."

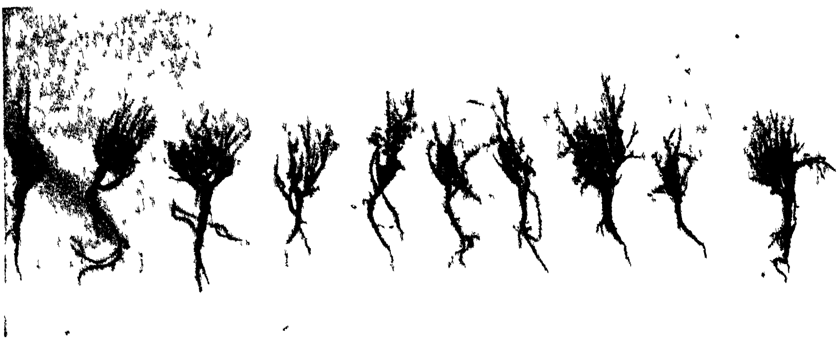


Fig. 1. Ten lucerne roots taken as they grew in drill row in field in Ford county, Kansas, sown on sod with press drill, spring of 1896, not disked, average thickness of root, [illegible] of an inch, average number of forage producing stalks on each root, 16

Fig. 2—Ten lucerne roots taken as they grew in drill row of field in Ford county, Kansas sown with press drill spring of 1896 disked and cross harrowed with slant tooth harrow, March, 1898 average thickness of root [illegible] of an inch average number of forage bearing stalks on each root, 37 8

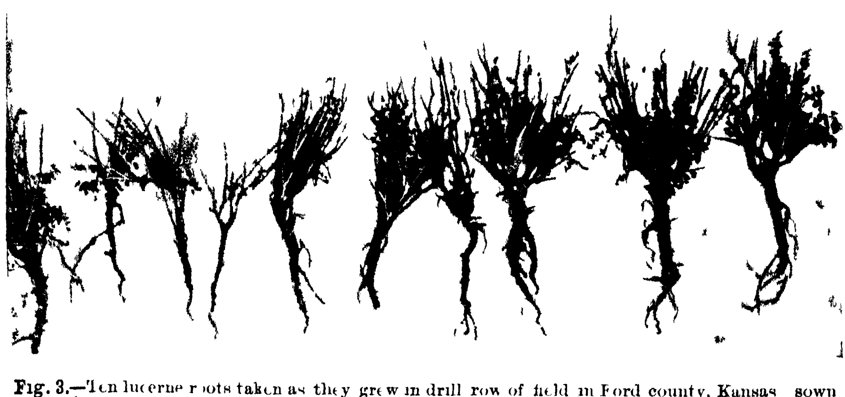


Fig. 3.—Ten lucerne roots taken as they grew in drill row of field in Ford county, Kansas sown with press drill on sod spring of 1896 disked and cross harrowed with slant tooth harrow, March 1899 average thickness of root, [illegible] of an inch, average number of forage bearing stalks on each root. 5 7

In connection with the cultivation of the encrusted surface of lucerne paddocks in some of the inland districts of New South Wales, where the soil in a dry spell sets like cement, no doubt there are many difficulties; but, from Mr. Smith's report, it will be seen that the same trouble is met with in Texas and Kansas. As evidence of the advantages to be gained by the stirring of the surface, the illustrations on page 226 are reproduced from the Biennial Report of the Kansas State Board of Agriculture.

In Kansas, lucerne growing has increased from about 34,000 acres in 1891 to nearly 300,000 acres at present, and a very large proportion of this acreage is not irrigated. It does not appear to return nearly so many cuttings or such tonnage as we in New South Wales are accustomed to obtain from lucerne, yet the crop is considered to be of such value that, to have an area of it which will return from one to three cuttings per annum, the Western Kansas upland farmer finds it worth his while to subsoil to a depth of from 18 to 20 inches, to grow cleaning crops for a year, and to keep the soil in a constant state of dust blanket with cultivation for another year and then to wait perhaps five years for sufficient rain to thoroughly saturate the soil before he sows the lucerne seed. As one of the best crops to prepare land for lucerne in these dry locations Soy-bean is recommended. It is found that the Soy-bean is a sparse user of soil-moisture, and in the growth of the Soy-bean, which will not tolerate weeds, the soil gets the cleaning that is essential for lucerne in its early stages. The two great foes of lucerne are lack of sufficient moisture and choking weeds during the first few months after germination. The effects of droughty conditions can be minimised by the careful preparation of a deep and retentive seed-bed, so that the moisture which saturated the soil at sowing time may be conserved a long time; and if the land has been thoroughly and continually scarified for a whole season prior to sowing, there is not much chance of weeds getting sufficient footing to choke the young lucerne plants. Some farmers in the United States, as well as in New South Wales, believe in sowing lucerne with some cover crop like wheat or oats. This practice may be right enough where the rainfall is reliable; but in districts of limited and irregular rainfall it is rarely that conditions are sufficiently favourable for the soil to maintain the vigorous growth of two crops at the one time, and it is generally found, as on the Murray some years ago, that it is the lucerne which suffers. When the young lucerne gets a check in this way it takes a long time to recover; in fact, it may never really get over the initial stunting. There is danger, too, when the lucerne is sown with a crop like oats or wheat, of the growth becoming delicate by the shelter afforded by the taller dense growth of the cereal, and when the spindly delicate growth is removed at the time of harvest in early summer, the sudden exposure of the butts to hot sunshine may effect permanent constitutional injury. Some years ago, Mr. Watson, Stock Inspector at Corowa, furnished, for publication in this *Gazette*, a report on the laying down of lucerne by pastoralists in the Corowa district. The area reported upon aggregated 21,000 acres, some of which had been sown with wheat but without success.

At that time (1896), fat stock were going from the Corowa district, which without the aid of the lucerne would have been impossible. As an instance of the help the lucerne pastures were, in increasing the carrying capacity of the runs, it might be mentioned that on the Collendina property of 26,000 acres, including 7,000 acres under lucerne, Mr. H. Hay carried and fattened 40,000 sheep and 700 cattle. Mr. Watson expressed the opinion that lucerne was perfectly safe, provided it had a good season to get established and was not over-grazed during the first year. The crops sown in a bad season did not succeed. A point of the greatest importance mentioned by Messrs. Marshall and Smith is the precaution that should be taken to prevent the young lucerne from running to seed. It stands to reason that a plant that is to withstand all the vicissitudes of, perhaps, ten years must have its energies concentrated on the development of a deep root-system, and it cannot do that and perform the exhausting functions of seed production at the same time. Some people realising the desirability of keeping down the above-ground growth of lucerne, turn stock or sheep into the paddock to achieve the purpose. It is possible that under an extremely careful system of limited grazing some good may be achieved in this way; but the point at which the grazing is no longer beneficial, but positively injurious to the young plants, is so easily overstepped that the risk is not worth taking. The use of the mower is far safer and more effective. Where lucerne is laid down in extensive areas for pasture, as would be the case in this State, it would be well to follow the American practice of mowing it for hay, or to be carted off and fed as greenstuff a couple of times a year. This could, in most years, be done at the times when there has been enough rain to promote growth in the natural pastures. The mowing not only stimulates the growth of the lucerne, but affords an opportunity of getting rid of the noxious weeds and barley-grass which are likely to be left untouched by sheep, and especially by cattle, so long as a bite of lucerne is available. In grazing, every care must at all times be taken to remove the stock or sheep as soon as they get down to the crowns of the plants. A well-established lucerne paddock will stand a lot of hard grazing, but the time lost in recovery makes it poor economy to graze too closely. While on the subject of lucerne as a crop for the stock-raiser, it may be of interest to reproduce some extracts from an article by Mr. D. A. Willey, in the *Scientific American*.

The writer prefaces his remarks by a reference to the wonderful strides made in recent years in American stock-raising on the great pastures of the West and South-west. It is known in a general way, he says, that live stock has been considerably improved recently by the modern systems which are employed on ranches; for no longer is the flesh driven off the bones of the cattle in forcing them to go mile after mile over plain and valley in search of new feeding grounds. Many of the ranches of to-day are divided into pastures, which, though perhaps covering 50 or 60 square miles in extent, are provided with an abundance of grown fodder.

While the majority of the great herds and flocks of the West as yet are of medium and low grade stock, the tendency is to breed a higher

grade of animals; for the ranchmen have realised that they can grow a kind of food which is especially suitable for such varieties as Herefords, Devons, Holsteins, and Durhams in cattle, as well as even Merino and Southdown sheep. This food is lucerne, which is perhaps one of the greatest blessings which has been bestowed upon the Western farmer and stock-raiser. Alfalfa is another name for lucerne, which in the South-west is called Spanish clover, because its foliage resembles this clover to a certain extent. It is an attractive plant, and only a few years ago was considered far more ornamental than useful. Now, however, it has been discovered that, not only horses and mules, but cattle and sheep thrive upon it, and will eat it in preference to any other grass that grows. The farm experts say that in contains as much nourishment for live stock as corn, and is as good as the best Timothy or other ordinary hay.

It grows so rapidly that in six months the mower can go over the field four or five times, and cut off from 1½ to 2 tons an acre at each harvest. As many as seven crops have been gathered in Colorado and New Mexico when special attention is given it. The seed is planted in the spring of the year, about 25 lb. being enough for 1 acre. The ground is first prepared by ploughing, and, after the seed is in, it is kept fairly free from weeds until the plant secures a start, when it does its own weeding; in fact, it is very independent, and practically takes care of itself until it is ready for the blade of the harvester. It can be piled or stacked like Timothy or any other forage crop, and when properly piled in a field is proof against the weather. Sometimes it is pressed into bales and stowed away; but most of the large ranch owners grow it in convenient places, stacking it up near their pens and pastures. They get a great deal out of their lucerne fields for a small amount of money, for the average cost of the seed, cultivation, harvesting, and stacking is only about 6s. 3d. per ton, where four crops are gathered in a season. One reason for the low cost of making the crop is that the ordinary horse cultivators and harvesters can be used, thus saving time and labour. Under irrigation, it grows so luxuriantly that a few weeks after the seed is sown, the plant may be knee-high, and sometimes waist-high in the field. Cattle and sheep eat it with the same relish, whether standing green in the field or pulled dry from the stack. After the harvest, sometimes hogs are turned into a lucerne pasture, and they actually fatten on it. It not only makes flesh, but a fine quality of flesh. Beef and mutton fed on it have an excellent flavour, usually superior to that coming from the ordinary ranches, where various grasses are depended upon for food, and where corn is also used for fattening.

The reports made to the Department of Agriculture from the various irrigated districts in the West show a surprisingly large number of flocks and herds of high-grade animals; in fact, the proportion in these sections is much larger than elsewhere in the country beyond the Mississippi River. It is due to the fact that the irrigation farms are raising so much lucerne. In the Pecos Valley, in New Mexico, there are herds aggregating 500,000 head of Hereford and Durham cattle alone. Some of the single herds contain 30,000

animals, while it is estimated that fully half a million blooded sheep are contained in the flocks which graze in the same vicinity. In the valley of the South Platte, Colorado, are also immense droves of blooded animals, and fully 100,000 cattle are now being sent to Kansas City, St. Louis, and Chicago, which have been raised almost entirely on lucerne. The packers pay the highest market price for these grades. They are largely exported on the hoof and in carcases, and many an Englishman dines on roast beef "made in America," but coming from stock which originally was raised in Devonshire or perhaps Durham.

The tendency among the Western cattle-growers is to raise more quality and less quantity, and for this purpose a number of very valuable herds of pure-blooded stock have been imported within the last few years from Great Britain. Nearly every large ranch has at least one or two registered bulls, and as fast as possible live stock growers are improving their strain. There should be no danger, however, of a meat famine on account of this revolution in cattle-raising, for last year Government statistics showed fully 25,000,000 beeves, nearly 50,000,000 sheep, and about 30,000,000 hogs owned by farmers and ranchmen in the United States.

When it is remembered, in conjunction with the foregoing, that in every part of the Argentine Republic where experiments have proved that it will succeed, lucerne is supplanting the indigenous grasses, it will be realised how important a factor this crop is becoming in the world's meat production. As in the United States, the Argentine estancieros or squatters follow to the letter the systems that scientific experimentation have proved to be the most effective in permanently establishing lucerne pastures on an extensive scale. The plantations are rarely if ever grazed during the first year, but sparingly in the second, and from the third season on it is customary to so arrange the grazing that there is never less than 2 inches of the plants left when the stock are removed to the next paddock. In 1901, there was a severe drought experienced in parts of the Argentine, and while the stock-raisers on the native grass ranges had to dispose of their herds at any sacrifice, those who had lucerne were not only able to carry their full capacity of stock, but in many cases take in more to graze. As an example of the carrying capacity of lucerne in the Argentine, the following figures from the account books of Mr. Nields, of Rafaela, Santa Fé, who has 1,500 acres of lucerne, may be quoted:—

Number of cattle on 1,500 acres lucerne.

1900.		1901.	
December...	1,645	June	1,644
1901.		July	1,597
January	1,451	August	1,746
February	1,122	September	1,674
March	1,193	October	1,889
April	979	November	1,888
May	985		

In addition, 150 horses are depastured all the time, making the average equal to 1·26 cattle per acre all the year round. In the same district it requires 6,672 acres to carry 1,500 cattle the year round. This means nearly 4½ acres of good land to each animal under the old conditions against 1·26 animals to each acre under the new.

In an article on Argentine's agricultural progress, Mr. Herbert Gibson, writing in the *Journal of the Board of Agriculture*, England, says, "It is already well known that in the zone lying to the north-west of Buenos Ayres, the inferiority and sparsity of the indigenous grasses led to the cultivation of the land for three to five years with wheat, maize, and linseed, and thereafter laying it down crops of permanently in lucerne for cattle-raising.

"The lucerne zone now includes not only the rich loam of the Province of Santa Fé, but has pushed south and west from there into the higher and sandier soils of Cordova, the North-central Pampa, and the Province of Buenos Ayres. Here the same process of triennial agriculture continues and the 'Alfalfa Country' extends its limits yearly. The cost of laying down new land in lucerne has decreased. Seed is cheaper, cultivation is cheaper, and its methods are improved. Landowners are making lucerne paddocks on a larger scale. There are three estancieros in Cordova who have combined forces and are laying down 400,000 acres in lucerne this year (1903)."

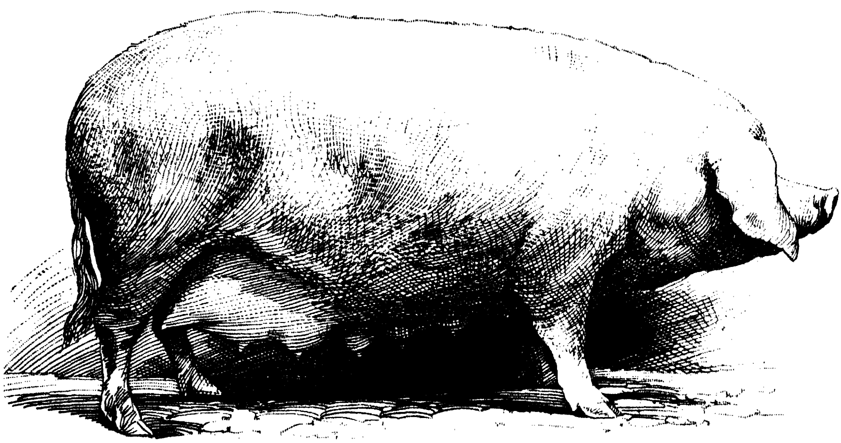
The Question of Adaptability of Soils.

The opinion is very generally held in New South Wales that it is only upon alluvial flats and patches of free-working dark soil that lucerne can be depended upon, and that when an attempt is made to establish it in the purely red soils, it may flourish for a time, but will gradually languish, as the roots come in contact with strata unfavourable to the plant which underlie some of the red soils. It is not very easy to get data on this particular point. We know that in some of the driest parts of the earth, such as Turkestan, there are to be found varieties of lucerne that thrive in what is practically desert country. Some of these creeping varieties have been tried here, but do not appear to have shown any superiority as fodder producers when compared with the upright Tamworth, Mudgee, or Hunter lucerne that has been so long acclimatised. Perhaps if the Turkestan lucerne were tried in places more akin to its habitat it might do better, just as in establishing the ordinary lucerne in semi-arid districts greater success might follow the use of seed from plants that have been acclimatised to drier conditions than those of districts from which the supplies of seed are usually obtained.

The Craonnaise Race of Pigs

By H. SAGNIER.
(In the Journal de l'Agriculture.)

NOWHERE has agriculture more completely transformed the conditions of the country than at Craon (France) and neighbouring districts. For many years this part of the country has been most prosperous, and the farmers have been enabled to sustain without difficulty the many bad years through which the country has passed. This is principally due to the careful breeding of pigs and cattle, and particularly in recent years to the great improvements effected in the former. The annual show, established in 1895, has also contributed to this result; no animal showing any sign of crossing with another race being admitted.



A Craonnaise Sow.

[In M. Sagnier's report the illustration of this sow appears twice, evidently in error, instead of the boar, which it would have been interesting to see.—Ed.]

The purity of the Craonnaise breed of pigs is indicated by a long body with strong legs; skin uniformly white, covered with white or yellowish hair; large flat forehead and long flat nose, forming a very open angle with the forehead, any black spot on skin or hair preventing admission to the competition. These strict rules were minutely adhered to, and the result was not long in showing itself.

The purity of the Craonnaise pigs from their native district is well known and highly esteemed, as is evidenced by the following facts:—

From one railway station alone in Craon 10,000 were despatched in 1895, and in 1902 over 25,000.

The despatches from other railway stations in the district were in the same proportion. These pigs were not only sent to other parts of France, but all over Europe, to Indo-China, New Caledonia, the Argentine Republic, &c.

The race has been known for a very long time for the value of its flesh, but the animals were of slow growth, and had rather large bones, which objections have now been removed by careful breeding. The pigs now are of a large size, very prolific, have a delicious flesh, the proportion of which to the lard is relatively large. The English races, on the contrary, have abundance of lard and a rather tasteless flesh.

Dealers also pay more for the Craonnaise pig than for the English, on account of its superior keeping qualities and the facility with which the flesh absorbs salt and preservatives. At present it is the champion breed; but at one time, when Anglo-mania prevailed, attempts were made to cross it with the best English. The only result obtained was a great increase in lard. Then the curing establishments, as well as the small-goods manufacturers, would only pay a lower price, and the experiment was abandoned. This proves how important it is to select only the best of the class, to have superior boars, to feed the animals well, and above all things to study their hygiene, which is absolutely necessary.

They must have carefully constructed styes, plenty of good water for washing, swilling, and even bathing. The French possess the champion breed at Craon, and as results prove it is well worth looking after. The total production of pigs of all kinds in France last year represented a value of over £20,000,000 (500,000,000 francs), and this at a relatively small cost. In fact, the pig is the most economic domestic animal—the best *animal machine* in the world, converting waste and cheap food into the most valuable and delicious food for the human race. It has been appreciated from time immemorial, and even in ancient Rome the consumption of its flesh was enormous. An up-to-date menu at the present time is never without some *recherché* dish of *le porc*, or in which it does not enter as an ingredient.

In America it has created colossal industries in such cities as Chicago, Kansas, Cincinnati, &c.

In the United States there is a law absolutely prohibiting the importation of any pigs, otherwise they would no doubt have made an extensive use of the Craonnaise breed.

That the pig industry of France should represent a far greater annual return than the sheep industry of New South Wales in the best of times seems to be almost incredible. But we must remember that the world's demand for pig products is enormous, Great Britain alone importing in 1903 over £25,000,000 worth of bacon, hams, lard, and fresh pork, and on British farms these are kept in large numbers.

Some More Little Object Lessons.

W. S. CAMPBELL.

I WAS bothered a good deal lately with some tomatoes which I have been growing in pots in the open air. They had grown well, and seemed to be healthy enough, although the pots were quite small, when all of a sudden they changed colour from a beautiful dark green to a sickly kind of yellow colour, and I fully expected that they would die off before my experiments were completed, after a deal of trouble in bringing them on so nicely. What on earth could be the matter with them? I looked to the drainage first of all, because when this is imperfect something generally goes wrong; and plants grown in pots or in the ground when badly drained frequently become sickly looking, and are liable soon afterwards to die away unless the drainage is improved. However, the drainage in the pots was all right. Then I tried a change of manure from the liquid made from fowl-droppings, which I generally use, to a concoction of nitrate of soda, muriate of potash, and some bone-meal soaked well, all together, in water; but this made no improvement, indeed it seemed as if the plants were even worse than before the new applications. I looked carefully for insect and fungus pests, but careful examination did not reveal anything of the kind, so, as I said before, I was considerably bothered.

Now, this impediment to success only added a stimulus to my work, for it is not always a good thing to have matters run too smoothly, and occasional obstacles now and then are, to my mind, rather to be welcomed than otherwise; it is so much more satisfactory to have something difficult to overcome, and one is always put on his mettle, as it were.

Observing the leaves through a microscope, I noticed a few green spots here and there, which were apparently gradually shading away into yellow, and it seemed obvious that the green would soon disappear altogether, and after that, I supposed, the plants would die.

Then a brilliant thought suddenly flashed through my mind. There is something wrong, said I to myself, with the chlorophyl—that is, the green colouring matter of the leaves, stems, and branches. This colouring matter consists of a vast number of granules, or, as sometimes expressed, corpuscles of a soft substance, which is of utmost importance to the life and economy of a plant. So far as I am aware, its exact chemical composition is unknown; but it is known that without a supply of iron this substance cannot be formed in a plant. The remarkable part of the business is that iron does not form portion of its composition. I feel much tempted to write a good deal about this strange substance, and its functions, but it would lead me wandering too far away from my subject.

Now, I felt that I had a glorious opportunity to try an interesting little experiment, so simple that anyone can follow the same course I

adopted if he has the opportunity of some sickly-looking plants to cure. The experiments need not be confined to pot-plants, but may be made on anything growing in the garden, orchard, or field. Of course, it should be thoroughly understood that it does not necessarily follow because plants may become yellow, sickly looking, or etiolated, that they are suffering from the same troubles as my pot tomatoes.

For a few pence I obtained half a pound of a well-known substance named sulphate of iron, or copperas. I pounded up half an ounce of this and dissolved it in 1 gallon of water, and after watering the tomatoes well with pure water, gave them each about half a pint of the solution, and then about two days afterwards gave them another half-pint each. The effect was magical. The plants recovered their colour, and became a rich dark green, and looked better than they had ever done previous to their sickness. Now and then I give them a little treat of the iron with the liquid manure I generally use, which is made by mixing up well in about 6 gallons of water two or three good handfuls of fowl-dung. Six gallons of water is used, simply because my largest watering-can contains that quantity, and it is the most convenient concern I have to use for the purpose. A few days after the fowl-dung is soaked in water, the liquid begins to stink most delightfully (that is, for a gardener's nose), and I use about a quart or so of this to a couple of gallons of water. If it be strained through a piece of fine muslin, it will be all the better. I may say that I use fowl-dung for the simple reason that it is the handiest manure for me to obtain, and it costs nothing. I use it for all sorts of plants, palms, gloxineas, ferns, begonias of many species, ornamental asparagus, and everything else for which I use manure. Sometimes for a change of diet I give the plants, always in a liquid form, nitrate of soda, bone-meal, and potash—say, a couple of handfuls of bone-meal, a handful of nitrate of soda, and a pinch, and, perhaps, none at all, of potash, in 6 gallons of water; then I allow this to ferment, and use as I do the fowl-dung. I am giving all this detail to enable anyone to grow really fine specimens of plants in pots, more particularly for a purpose I shall explain presently.

The accompanying photograph taken by Mr. Grosse, our artist, shows three of the tomato plants grown by me. The small plant (No. 1) was bearing and ripening four fairly good tomatoes of beautiful colour, and tempting to look at; and Mr. Grosse, who carried the plant home, says they were excellent.

The large plant (No. 2), which is growing in a 5-inch pot, has been allowed to ramble away at pleasure without training or pinching to produce fruits, but it is bearing a good many.

Plant No. 3, which has been trained to a slight degree, and tied up to a single stick, was grown for ornamental purposes, and extremely handsome it is with its bright-coloured rich looking, normal-sized fruits; it is bearing fourteen tomatoes altogether.

All my plants have been grown and kept in the open garden without any protection whatever. They consequently suffered many vicissitudes and calamities.

Fig. 1. Fig. 2.

One of my chief reasons for contributing this paper is to suggest to those teachers in private and public schools who are taking an interest, and have some desire to impart instruction in elementary work connected with horticulture and agriculture, an easy method of providing themselves with excellent objects on which to give instruction, and I doubt whether anything more interesting could be provided especially for a country school.

The whole beautiful little story of the growth of a plant can be related from the living specimen—the germination of the seed, the growth of root, stem, branches, leaves, the formation of the flowers and fruit to the seed again, thus completing the cycle. The system of hybridizing to produce new varieties can be explained, and I doubt whether any better class of plant could be selected for the whole thing than the tomato. No end of instructive simple lectures could be given by anyone who may be conversant with even the elements of practical botany.

I will take the opportunity here of referring to a remarkable experiment made somewhat recently in England by George Massie, a well-known authority on fungus diseases, with tomato plants, to render them immune against fungus parasites. Cucumbers were also experimented with

Fig. 3.

The cucumbers were of the varieties known as "Telegraph" and "Every Day," and the tomatoes "Up to Date" and "Main Crop." Three hundred cucumber seedlings and an equal number of tomato seedlings were subjected to experiment, fifty of each being used as check plants. When the seedlings were a fortnight old, the cucumbers were grouped round eight large cucumber plants badly affected by *Cercospora melonis* (Cke.), and *Dendriphium comosum* (Wallr.), and the tomato seedlings were ranged on tomato plants bearing numerous blotches on the leaves caused by *Cladosporium fluvum* (Cke.) At this period the specific course of treatment consisted of watering the plants every third day with a solution consisting of 1 part of sulphate of copper in 7,000 parts of water. The check plants, which were not watered with the copper solution, were indiscriminately mixed with the treated plants. The watering was done during the afternoon, and the quantity used for each plant was sufficient to soak the soil thoroughly.

After a month's treatment, all the tomato plants were perfectly free from disease. On the other hand, one or both cotyledons of thirty-four cucumber plants showed blotches of the disease. At the same time a considerable number of the untreated check plants, both cucumbers and tomatoes, were badly diseased. At this stage, both treated plants and checks were sprayed with water containing the spores causing their respective diseases, and this was continued weekly until the end of the experiments. Under this drastic treatment, all the untreated check plants, both cucumbers and tomatoes, were badly diseased during the following two weeks.

About six weeks' treatment with the solution of sulphate of copper of the strength instanced above, the strength was increased to 1 part of solution of copper in 6,000 parts of water, and the soil in which the plants were growing was soaked every fourth day until the end of the experiments, which lasted for eleven weeks. At the expiration of this period, both cucumber and tomato plants were bearing a good crop of well-grown mature fruit.

Not a single one of the tomato plants treated with the sulphate of copper solution showed a trace of disease, and in the case of the treated cucumber plants the disease never extended beyond the cotyledon, and this, notwithstanding the fact that badly-diseased plants were growing amongst the treated plants throughout the entire period. In addition to this, the treated plants were sprayed several times with water containing spores of the fungus parasites in suspension.

It is important to bear in mind the fact that the above method of treatment for producing immunity against fungus parasites applies to cucumbers and tomatoes only, so far as direct experiments have been carried out. A solution of sulphate of copper appears to have markedly different effects on different kinds of plants. *Luffa ægyptica* (Mill.), a close ally of the cucumber, is killed by two waterings at a strength of 1 in 6,000. Barley, on the other hand, remains perfectly healthy when treated with 1 in 500, and in addition may become badly attacked by its common parasite *Oïdium graminis* (P.).

It must be noted that sulphate of iron, although called copperas, is an entirely different substance from the sulphate of copper above referred to.

Now tomatoes were not the only pot plants which troubled me this season, for some of my small fruit trees, the apples and pears, took a fancy into their heads not to set their fruit although bearing unusual numbers of flowers.

Fig. 4.

Luckily for me two of the apples came into flower some time after I noticed that the others had not set any fruit. So I thought I would try a very old dodge which I believe proved effective.

Some years ago I had a large old Windsor pear-tree which had never borne fruit, so far as I could ascertain. It struck me as being worth while to try the effects of an operation I had seen when a lad successfully performed by an old English gardener. This was simply girdling the stem and removing a strip of bark about a quarter of an inch wide, but not quite into the wood. I stripped off the bark as explained above, when the tree was in full bloom, with the result of a splendid crop of fruit. The bark soon grew over the wound and the tree bore abundance of fruit for years afterwards without being operated upon again.

There has been a good deal of attention given to the girdling of fruit trees lately, chiefly in connection with grapes and currants; so I thought I would have a try on the two little apple-trees. I simply made a deep cut into the bark, not quite a circle, but did not remove any bark, with the result that both these pot-apples set a considerable quality of fruit, some of which (about three-quarters matured) may be seen in the illustrations. Many of the apples were knocked off before they were large enough to photograph. There were about 13 or 14 on each tree before the photograph was taken, and each fruit varied from 2 to 3 inches in diameter. Unfortunately, just after the picture was taken, some boys, evidently considering that I had no right to the fruit, smashed the apples off the plants and played the mischief in my small

garden, trampling down a number of flowering plants in their haste to secure the spoil. This experiment, therefore, had a most melancholy ending, but it was sufficiently complete to show that the chances are in favour of girdling or partly girdling such plants should they not set fruit after a trial of a year or two.

Should anyone make a trial of growing fruit in pots, and can afford time to develop his plants from the start, let him head them low and keep his lowest branches not more than 6 inches from the top of the pot. The stems of those shown in the illustration are too high altogether, for I had to take what I could obtain from the nursery, and they do well enough for my own requirements and the little experiments I am inflicting upon them.

Fig. 5.

Fruit trees in pots should prove of great value in connection with botanical and horticultural object lessons, for not only could the whole plant system be explained but instruction in manuring, pruning, training, fruit thinning, the growth of fruit-bearing wood, fruit spurs, flowers, and so on, could be given. And as these plants can easily be carried about and taken indoors, they will be found very convenient.

I feel sure that any enthusiastic teacher who will take the little trouble necessary to provide himself with a few different kinds of plants in pots, and give a few simple lessons about them, could not fail to arouse an interest amongst his pupils that would never be forgotten, and which might lead to important results.

He need not attempt to grow his plants in such small pots as I generally use, for I have objects in view in limiting the root areas, which would not perhaps be desirable to follow at present.

Locusts and Grasshoppers.

By WALTER W. FROGGATT, F.L.S.,
Government Entomologist.

Part II.

The first part of this paper dealt with the short-horned locusts, commonly known in the country as grasshoppers, among which were our true plague locusts and closely allied forms. This portion also deals with *Acridiidae,* but many of them represent solitary species that seldom or never gather together in numbers, and live in open forest ranges and the dry plains of the interior.

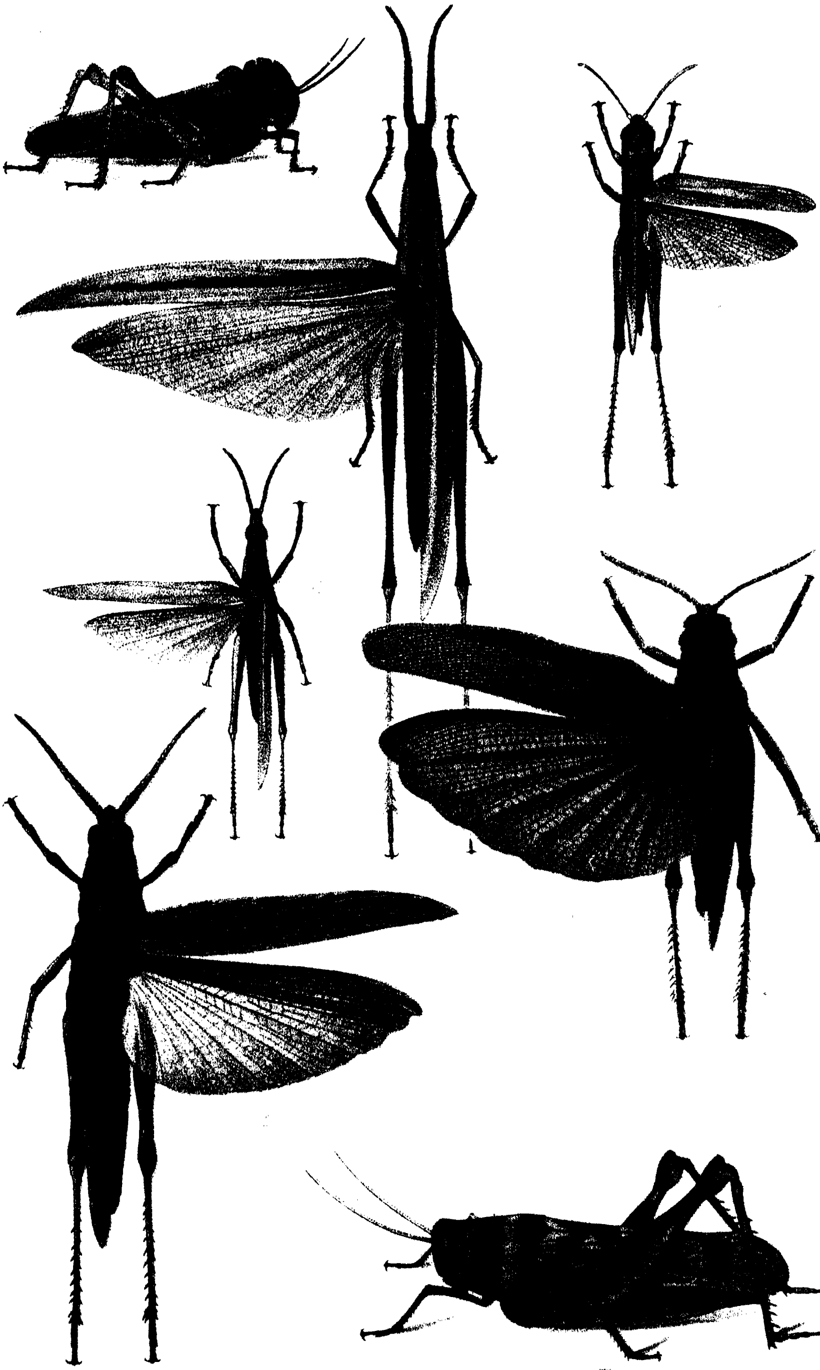
The Large Tryxalis (Tryxalis rafflesii, *Blanchard*).

This tribe contains a number of very slender grasshoppers with long narrow heads coming to a point in front, with short, somewhat flattened, lance-shaped antennæ, standing out in front of the eyes. Their general colours are greens or browns, which are generally in harmony with their surroundings, so that in spite of their size they easily escape detection unless disturbed. They have very long slender fore wings, coming to a sabre-like point at the tips, with large membraneous hind wings, well adapted for flying, but their hind legs are so long and slender that when they alight among long grass they seem to be somewhat awkward.

The large *Tryxalis* measures up to 3¾ inches across the out-spread wings, and 3 inches in length, including the short antennæ; the male somewhat smaller. The general colour is delicate grass green, with a slender stripe of salmon pink along the sides of the head, thorax, and along the inner edge of the fore wings, and a similar finer parallel stripe along the front margin, inclosing a central broader green stripe mottled with black on the hind edge. The hind wings semi-transparent, lightly shaded with green, the antennæ and legs striped with salmon pink. In some specimens the whole of the fore wings are of a uniform green tint, in others the pink-salmon markings are light and ill-defined. Though these grasshoppers fly very well, their movements are awkward, and their long hind legs give them an ungainly appearance. This species has an extended range along the eastern coast, and is not uncommon in suburban gardens, and their favourite haunt seems to be open grassed gullies between the hills. A fine series was collected at Moruya in February.

The Pink-winged Tryxalis (Atrastemorpha crenticeps, *Blanchard*).

This is a smaller insect, the female measuring only 2½ inches across the extended wings, and 1¾ inches in length from the tip of the antennæ; the male much smaller and more slender in form.



The general colour of both sexes is dull green, but the tints are very variable; the hind wings deeply tinted with rose red, brightest at the base and fading out at the extremities, which are semi-transparent; when alive the upper surface of the abdomen and base of the fore wings are usually more or less brightly coloured.

The head is more pointed at the apex than in the former species, with the upper surface of the thorax finely granulated, forming a well-defined ridge on either side of the head in a line with the eyes.

This species is common on the Tweed and Richmond Rivers, but extends as far south as Sydney.

The Ridge-backed Grasshopper (Goniæa Australasiæ, *Leach*).

This fine insect was described and figured in a very good coloured plate by Leach in his *Zoological Miscellanies* in 1814, under the name of *Locusta Australasiæ.* Walker later on placed it in the genus *Tropinotas*, and recorded it from Swan River, W.A.; Adelaide, S.A.; Hunter River, N.S.W.; and Tasmania. It is common in all open forest or ranges in Victoria and this State. The female measures up to 2 inches in length, and 3¾ inches across the outspread wings; the general colour is dull reddish brown, with the hind wings semi-opaque yellowish brown, and the tips darker. The antennæ are slender; face, keeled in front, and eyes projecting; the thorax long, extending beyond and overlapping the base of the hind wings and compressed into a sharp ridge along the dorsal edge, and finely rugose. The fore wings are narrow at the base, rounded in front to the extremities, the whole irregularly blotched with rounded spots. The hind wings are large and well adapted for flight, but when disturbed this grasshopper seldom flies very far, and frequently only jumps into the next tree. The abdomen is stout, and when alive varies from dull purple to brownish pink. The colouration and form of the male is similar, but he is much smaller.

Stoll has described a smaller species under the name of *Goniæa furcola*, differing chiefly in the lighter yellow tint of the thorax and base of the hind wings, and the fine rugose markings on the head and thorax. Tepper describes two new species, *Goniæa arcuata* and *G. fusca* in the "Zoology of the Horn Expedition from Central Australia."

The Gray Bark Grasshopper (Coryphistes cyanopterus, *Charpenter*).

This species represents a group, in which the members are solitary and usually found during the day resting on a tree trunk, with which their colour matches so well that unless they move they can easily escape detection.

The female measures over 3½ inches across the outspread wings, and about 2¼ inches in length. They vary a great deal in colour, from grayish mottled brown to almost black. In the more typical light-coloured variety, they are of a uniform grayish brown, mottled all over with darker tints; the hind wings semi-opaque light brown, with the basal portion shaded with light blue, and the inner surface of the

hind legs and abdomen dull purple. The antennæ are long, slender at the base, but swelling out beyond, and again contracting to a lance-shaped tip; when at rest they project straight out in front. The head is short, coming to a blunt point between the basal joints of the antennæ; the thorax is rounded on the dorsal surface, somewhat rugose, bearing a slight median suture, and irregularly rounded behind. The fore wings slender, curved, and somewhat sabre-shaped, very stout, and closely veined at the base, and pointed at the tips.

This species frequents open forest country, and has a wide range all over the eastern half of Australia.

The Crested Grasshopper (Ecphantus quadrilobis, *Stal.*).

This is one of the solitary forms met with on the sandy ridges and open plains of the interior, with probably a wide range over the western country, as I have taken them at the Grey Ranges on the north-western corner of this State, and specimens in the Departmental collections come from around Tamworth. It measures under 1½ inches in length, with a wing expanse of 2¼ inches. When alive the insect is of a uniform dull green, but this is variable, some specimens shading into greenish yellow; dried specimens become light yellow, with a more or less faint greenish tint. The head is short, broad in front, covered with fine tubercules, the antennæ slender, eyes large, and the whole insect lightly clothed with short fine hairs, thickest on the legs and undersurface. The thorax is somewhat rugose, with the dorsal portion produced into a crest or ridge divided into four distinct pieces, the first three erect, with the fourth turned back over the base of the wings; the fore wings moderately long, rounded at the tips, with hind pair pale brown; the thighs of the hind legs are spined along the inner edge.

Tepper describes two new species of this genus in his paper on the "Orthoptera of the Horn Expedition to Central Australia," under the name of *Ecphantus cristatus* and *E. ayersii*, both of similar colour and general form to our species.

The Spotted Ground Locust (Stropis maculosa, *Stal.*).

This is a type of the short thick-set locusts that sit about on the ground and rocks in the dry western country, generally only making a short jump when disturbed, and seldom going to the trouble of flying. All our specimens come from west of the Darling River, where they are met with generally solitary or in pairs. This locust measures under 2 inches in length, and nearly half-an-inch across the centre of the thorax when the wings are closed; its general colour is a dark brown, with the sides of the head and thorax barred with light yellow, and the fore wings richly blotched with the same colour, giving it a regular mottled appearance; the hind wings large, semi-tranparent, with a faint-pinkish tint, deepest towards the base.

Another species, *Stropis ocellatus*, Tepper, is described in the "Zoology of the Horn Expedition from Alice Springs, Central Australia."

The Striped Locust (Heteracris australis, *Walker*).

This small grass-haunting locust is found on the grassy flats in the neighbourhood of Sydney, but is seldom very numerous. It was described by Walker from Swan River, Western Australia, so that it probably has a wide range round the coast; two other species are described by him, one with the vague locality Australia, and the other from Port Essington, North Australia. It measures 1¼ inch in length, and 2 inches across the wings; the general colour is light brown, the lower edge of the thighs of the hind legs striped with yellow, the shanks mottled with black and yellow, red in the centre; abdomen orange-red on the upper surface. The characteristic marking is caused by a slender stripe of light yellowish brown running down either side from the front of the head behind the eyes, crossing the thorax, and running down the inner edge of the fore wings, so that it forms an inner wedge-shaped brown stripe, enclosed with lighter ones down the centre of the dorsal surface.

The Slender Yellow Grasshopper (Oxya velox, *Fab.*).

The difference in the size of the sexes of this species is very marked, the female measuring 1¾ inch in length, with a wing expanse of 2¾ inches, while the male seldom exceeds 1 inch in length, and 1½ inch across the wings. The general colour of the upper surface is reddish brown, sometimes the head and thorax tinged with yellow, both barred on the sides with dark brown, below which is a stripe of green marked with yellow. The apical portion of the thorax and legs yellow tinged, with blue upon the shanks of the hind pair; fore wings long, rounded at the tips, shaded with green in the female, and reddish brown in the male; hind wings transparent.

These locusts are plentiful along the Clarence and Richmond rivers, but do not come down as far south as Sydney.

NOTE.—*Goniaea australasiae* is figured and described by McCoy, in his Natural History of Victoria, Podromus of Zoology Decade 14, 1887, page 140, under the name of the "Cinnamon keel-backed locust" (*Tropinotus australis*, Leach). He also figures *Coryphistes cyanopterus*, under the name of "The dusky flat-horned locust," as Servielle's *Opsomala sordida*. On the same plate a species of Tryxalis is called the "Pedestrian mid-eye locust," under the name of *Mesops pedestris*, Erichson, which appears to be identical, or closely allied, with the species figured by me as *Tryxalis rufflesii*. My specimens have all been examined and named by Mr. W. F. Kirby, of the British Museum, who has made a study of the Orthoptera.

Useful Australian Plants.

By J. H. MAIDEN,
Government Botanist and Director, Botanic Gardens, Sydney.

No. 87. Sweet Scented Grass, *Hierochloe redolens*, R.Br.

Botanical name.—*Hierochloe* or *Hierochloa*, from two Greek words—*hieros*, holy; *chloe*, grass. It is generally and properly spelt *Hierochloa*, but Gmelin, author of the genus, spelt it *Hierochloe*; *redolens*—Latin, smelling sweet.

Vernacular name.—"Sweet-scented grass."

Where figured.—Labillardière, as *Disarrenum antarcticum*; Buchanan.

Botanical description (B.Fl., vii, 558).

Stems tufted, erect, branching, leafy, 2 to 3 feet high.

Leaves flat, rather rigid, slightly scabrous, otherwise glabrous, the ligula scarious entire.

Panicle rather dense, secund or nodding, 4 to 10 inches long in the larger forms, the spikelets crowded along the primary branches, forming spike-like secondary panicles of 1 to 1½ inches, the upper ones sessile, the lower distant on clustered filiform peduncles.

Glumes all thin, almost hyaline, rather shining; outer empty ones in the typical form about 3 lines long, the short lateral nerve on each side more prominent in the second than in the outermost one.

Third and fourth glumes each with a male flower, nearly as long as the outer ones, ciliate on the margins and keels, with a short awn arising from a little below the tip, the rhachis of the spikelet shortly lengthened between and above the male glumes.

Fifth and sixth glumes enclosing the grain obtuse and perfectly glabrous, or the fifth slightly hairy at the end with the keel produced into a minute point.

Value as a fodder.—Believed to be nutritious, but quite harsh when old. It is one of the few grasses which grow in cold moorland, and hence valuable in that respect. Its odour of Coumarin (pleasing to cattle when not too strong), renders it an acceptable ingredient of hay, and it often renders damaged hay more palatable to stock.

Habitat and range.—Found in Tasmania, Victoria, and New South Wales. In our own State it is found in the southern mountain districts. It also occurs in New Zealand and Antartic America.

REFERENCE TO PLATE.

A. Coarse form.
B. Small or alpine form.
C. Outer empty glumes of the spikelet.
D. Third and fourth glumes of the spikelet, each with a male flower (concealed) and a palea.
E. Fifth and sixth glumes with the hermaphrodite flower and the grain.

[Both of the specimens were obtained from Mount Wellington, Tasmania. They are better specimens than those in my possession from southern New South Wales.]

SWEET SCENTED GRASS.
(HIEROCHLOE REDOLENS, R. BR.)

HARD FESCUE.
(FESTUCA DURIUSCULA, LINN.)

No. 88. "Hard Fescue," *Festuca duriuscula*, Linn.

Botanical name.—*Festuca*, Latin, the shoot or stalk of a tree or herb (the appellation not being specially appropriate); *duriuscula*, Latin, somewhat rough or harsh, the texture of the grass being thus described.

Vernacular name.—"Hard Fescue."

Where figured.—Buchanan.

Botanical description (B.Fl., vii, 663).—An erect perennial, of 1 to 2 feet.

Leaves chiefly at the base, very narrow, almost setaceous.

Panicle loose, but narrow, 2 to 4 inches long, with few erect branches.

Spikelets not numerous, erect, usually about ½ inch long, four to six-flowered.

Glumes rather rigid, the outer ones pointed, the lowest very narrow, keeled, scarcely 2 lines long, the second rather longer, three-nerved.

Flowering glumes 3 lines long, or rather more, faintly nerved, glabrous or pubescent, with a fine point or awn, usually about 1 line long.

Palea with a fine bifid point.

Stamens three.

Value as a fodder.—A useful pasture grass for the colder regions of the State. It grows well in hilly places, and is one of the best of the smaller fescues. It forms a close turf. All kinds of stock eat it readily, although it is somewhat harsh. Seed may be procured of most seedsmen.

Habitat and range.—Found in all the States except Western Australia and Queensland. In New South Wales, apparently confined to the mountainous districts of the south-east. "One of the most widely dispersed forms of the sheep's fescue, or *F. ovina*, Linn. Very abundant on downs and hilly pastures of the temperate regions of the new and old world." Bentham.

I have gone very fully into the value of *Hierochloes* in general in the article on *H. rariflora* in the *Gazette* for June, 1894. Much of the information therein given may be read in conjunction with the present article.

REFERENCE TO PLATE.

A.—Specimen of the southern form, from Nimitybelle, Monaro.

B.—Specimen of the northern form, from Walcha, New England. This is the most northerly locality recorded, and is a tall form, with large spikelets and rather long awns (approaching the variety *Aristata*, from Victoria and South Australia). The panicle is rather broad, and often about 10 inches long.

C.—Spikelet enlarged.

D.—A spikelet with five flowers, enlarged, showing—

- *a.* The outer empty glumes.
- *b.* The flowering glumes.
- *c.* The palea.
- *d.* The upper empty glume.

Two more New Weeds.

The cry is, "Still they come!" The first is the Buffalo Burr of the United States (*Solanum rostratum*, Dunal) which has been sent by a correspondent from near Boggabri. It is closely allied to the potato and tomato, but instead of having a smooth fruit as those plants do, it has spiny burrs, somewhat resembling those of the Burdock at first, but developing at maturity into nearly spherical spiny balls filled with black, irregular seeds. These burrs attach themselves to passing animals, and help to spread the pest. The plant has yellow blossoms, and a profusion of prickles. It is a plant of 1 foot to 2 feet high, and is an annual. If, therefore, it be eradicated before it matures seeds, there ought to be no difficulty in getting rid of it. It is a native of the western plains of the United States, but has spread over a large number of States, and the agricultural stations of most of them have issued illustrated bulletins warning people against it. Its commonest name is that already given, but it is also called Beaked Horse-nettle, Rocky Mountain Sand-burr, and Spiny Night-shade. It prefers sandy soil. It is usually disseminated in dirty seed. How it got to Boggabri I do not know, but it is not likely my Boggabri correspondent is the only one to get this bad weed.

The second plant is *Potentilla erecta*, Linn., a far less serious weed. It is a native of Europe, and my plants hail from near Tumberumba. It belongs to the rose family (*Rosaceæ*), and is one of a genus known as cinquefoil, or five-finger. The flower is yellow, and while the plant is somewhat astringent it is not in any way poisonous. Its nutritive value is probably small, and hence its room is preferable to its company in pastures. Small patches of it should be eradicated (it has a long, tough root) before it seeds.—J. H. Maiden.

Cattle and Horses Eating the Bark of Trees.

Mr. J. H. Crouch, of Eugowra, writes:—"I have noticed cattle at times, but more frequently horses, gnawing the bark off the trees for the last twenty-five years. They usually attack the box more than any other timber. I cannot say for a fact why they eat the bark, but am of opinion it is for want of salt, and when my stock take to bark-eating I give them salt, and notice they leave off almost at once."

The Culture of Fresh-water Fishes.

ALBERT GALE.

THE benefits derived from the culture of fish must not be confined to one idea, that is, to the procuring of a toothsome luxury for the meal table. That in itself is worth the taking of the initiatory step, for, if nature has planted the necessary conditions in any locality for the propagation of fishes, but has withheld the all-important adjunct fish, there is little more to be done than to supply the deficiency. Apart from the domestic supply to be obtained there are other advantages that it is as well here to enumerate. Of course, the angling for a breakfast in the early morning will suggest itself. Young people of both sexes are always more or less keen on such a pleasure as that of trying to catch fish, especially so, when it is known there are fish waiting to be caught. It is well known that in many districts one of the plagues of life is the intolerable nuisance occasioned by the attacks of mosquitoes. These troublesome insects form their boats of eggs, and moor them to a weed or other floating object. The larvæ hatched are denizens of water. Stagnant water is their especial haunt. Mosquitoes have no choice as regards the quantity of water necessary for them to breed in. A bucketful left standing for a day or so will be sure to attract them. 400-gallon iron tanks literally swarm with them. Oftentimes the only way to get into these tanks for breeding purposes is by means of the down pipe. An open waterhole is a perfect paradise for them. Put a few fish of any variety in such places where the mosquitoes breed, and they will soon make a meal of the larvæ. There is nothing better for the rearing of young fish than mosquito larvæ. Thus fish purify the water by preventing the decomposition of the chrysalis case of the various insects that pass one stage of their metamorphisis in water.

I have said elsewhere that it is imperatively necessary that there should be a good supply of aquatic plants in every waterhole where fish are to be kept. These, in varieties, can be obtained in any of our fresh-water creeks and lagoons. When once these plants establish themselves they are likely sometimes to make too much headway, nevertheless their exuberant growth aids much in preserving the water both in quality and quantity. Plants that float on the surface of the water keep the water cool. Again, in summer time, in water-holes it will be noted that an impalpable green, mossy-looking substance (*Confervæ*) becomes very abundant. This growth and the growth of aquatic plants generally can be kept fairly well in check by the introduction of shell-fish. In many of our creeks,

waterholes, and rivers there are to be met with large quantities of molluscs (fresh-water shell fish). These water snails grow to about an inch long. They are wonderfully prolific. From the Hunter River I have picked the young ones up by the handful. These are the scavengers for fresh water and at the same time they serve as a food for the fish. There are other kinds of shell fish to be met with, notably varieties of mussels, these are all more or less useful in fish-culture. Nevertheless, useful as these pond snails are they sometimes take a stray fish egg for breakfast, but for such an act we can forgive them, seeing the amount of good they do. I have seen fully a dozen of them devouring the carcase of a small dead fish, but never once have I seen them on the body of a healthy one.

There are many aquatic insects, or rather that are aquatic in some stages of their transformation. Many of them are fish enemies, notably dragon-flies, which feed on the young and helpless fry, but these in their turn become food for the adult fish. Where there is water these insects abound. From the early dawn to the gloaming they can be seen skimming over the water like so many swallows. During the day they are chiefly engaged in depositing their eggs. In the evening they seem to be chiefly concerned in hawking for mosquitoes. On the northern rivers of this State they are more commonly termed mosquito hawks than dragon-flies. These insects, whilst in a larval state, feed largely on the larvæ of other insects and also on young helpless fish.

Therefore, in the early period of establishing or entering into the culture of fresh-water fish, these facts should not be overlooked. It may be found necessary at the outset to have resort to artificial culture, *i.e.*, to breed fish away from their enemies, or near at home where they can be more or less watched and protected from the enemies named. There is nothing in the artificial rearing of fish for stocking fish-ponds or waterholes to dismay anyone. A schoolboy can manage it. The chief secret of success is protection from enemies.

Waterfowl, both wild and domesticated, should be kept away from fish-ponds. They do little or no harm to grown fish, beyond disturbing them during breeding season, but fry are very dainty morsels to their palate. Those birds that live on fish, such as shags and cormorants, will catch and devour fish of almost any size. The gun should always be levelled against them.

Frogs when small and in a tadpole state form excellent food for fish. Tadpoles feed on vegetable food, therefore, these should be encouraged rather than destroyed, notwithstanding the author of the "Complete Angler"—Walton—seriously affirmed "that frogs do lay their eggs around the necks of fishes and thereby strangle them."

There are many diseases that fish are heir to. These are chiefly brought on by overcrowding and thereby an insufficiency of food. These diseases chiefly appear when fish are kept in tanks, although an epidemic will sometimes occur when fish have every advantage of food and freedom that Nature can give.

All animals are more or less attacked by parasites, and fish are no exception, but I think salt-water fish are more liable to be attacked by

parasites than those of fresh water. I have noticed these parasites among my own fish that are kept in glass aquaria. When the fish are swimming near the glass sides, with the aid of an ordinary lens I have noticed parasites clinging to the scales underneath the pectoral fins. Of course, most of my aquaria fish are small. By putting a tablespoonful of salt in a medium size basin of water I have generally succeeded in removing these too neighbourly neighbours.

The object to be attained in this artificial culture is: that it should approximate as nearly as possible to natural conditions. The water, therefore, should be stocked with the inhabitants from rivers or stagnant water holes, both vegetable and animal. Care should be exercised in introducing known fish enemies.

Co-operative Sale of Cereals.

In Germany and France, where the farms are of small area, co-operation is becoming more and more general as its advantages are demonstrated.

In the continental co-operative stores the farmer obtains partial cash payments as soon as he has delivered his grain. After being cleaned and weighed, the waste is returned to him, and a certain price fixed. The manager, who should be well acquainted with the requirements of the trade, grades the wheat, barley, or oats which he receives, and the different crops of a certain district are generally sufficiently homogenous to enable him to sort each kind in two or three qualities, which accumulate separately until the time of sale. He can then offer to the millers large quantities of uniform quality, and spread deliveries over such periods as desired, if accepting contracts for the army or other large purchasers. He is thus able to secure a much higher price, and if the store is erected near a railway or canal, the cost of transport is considerably reduced, and the profit increased in proportion.

By combining with the sale of the crops of the associated farmers the purchase of their seed and fertilisers on a larger scale, a great saving and improvement can be effected.

All agricultural societies ought to impress these matters on the farmers as being imperatively necessary to progressive agriculture.

A Sketch of the Position of Viticulture in Europe with respect to Phylloxera.

M. BLUNNO.

PHYLLOXERA wrought so much ruin on the European viticulturists, and as it is still making headway in districts that so far had been spared, the phylloxera question, although some thirty-six years old, is still a burning and vexed one.

The respective central and local governments, as well as viticultural associations and vignerons' syndicates, have not in any way relaxed their strenuous efforts to stem the invasion of this implacable enemy of one of the finest agricultural pursuits. The fight *à outrance* is still continued to protect those viticultural zones where the parasite has not as yet made its appearance, inasmuch as the knowledge of thirty-six years has shown that no vineyard is safe except under special circumstances, while for the others it is only matter of time.

The war waged against this pest is, in consequence of past experience, conducted on different strategic lines, suggested by the notion that the most energetic and even drastic measures will but delay a general contamination. A viticultural territory some distance away from a centre of the pest may remain unaffected for a long time indeed, but an oversight, an imprudence, such as importing one single infected vine into such territory, will be the spark responsible for imminent destruction.

Numerous and laborious are the studies on the life-history of phylloxera, which is very complex, and very few instances of animal life offer such biologic variations as phylloxera does under different environments.

When it was ascertained that this pest is of American origin, and lives parasitically on the wild vines of the forests of that continent, a genial logic opened the hearts of viticulturists to hope in an indirect way of preventing the ravages of the tremendous scourge.

"If phylloxera is an exclusive parasite of the vine and will kill its host, in the course of time the pest would necessarily have disappeared through having destroyed the only plant on which it is possible for it to live; but, as there is still phylloxera, there must be a sort or sorts of vines which will harbour it and will not die by its parasitism. Let us see to what account such vines might be put in economic viticulture." This was the argument of those who were first engaged in the study of the difficult problem. Naturally, the search for such vines was to be made in America, the home of the disease. In 1873 Planchon went on his errand, and travelled through the United States forests, followed some time later by Viala. The hope was realised; phylloxera-resistant stocks were brought into France.

With this fresh addition to the European flora the whole attention of savants was, if not diverted from the study of the parasite, certainly divided with that of its original host. The complex matter began to be looked at ever since from different standpoints. Vignerons whose vineyards were in immediate danger were appalled by the rapid and complete destruction that followed where this pest was discovered, by its cunning in eluding every possible prevention that could be thought of then, and when their vineyards shortly after were turned into a waste, they naturally clung fast to the only plank of salvation thrown out to them in the shape of a few thousand cuttings and of a number of seeds of American wild vines which, it was said, would defy the attacks of the terrific parasite. So the reconstruction of the French vineyards began. Phylloxera had already conquered a portion of the viticultural territory of France; the owners had to come to terms with the invader. At that time phylloxera had only made an inroad representing but a very small area, and the vignerons who felt safe on account of the scourge being yet very far from their farms, and even those in touch with the enemy, were all of one mind, that is, they wanted the total eradication of the evil, and, if this were not possible, to surrender the ground where the foe was entrenched, to outflank and surround it in its stronghold and starve it out there. Strips of vineyards around the enemy's camp were destroyed to prevent incursions from the phylloxera-flying columns, the siege was made as complete as possible, yet the defenders did not know the ways and the stratagems of an enemy, which can not only fly, but also travel underground; which is light and can use the wind for passing the line of defence; which is small, dwells in the soil, and gives no outward sign of its presence until it holds a position so strong that it cannot be ousted, except at a great loss to the vignerons attacked. So the fighting vignerons would be continually surprised by finding that phylloxera had passed the line of defence and firmly established itself at their back some leagues away. Precipitous flight of the defending army ensues, with surrender of large tracts of territory, which are formally annexed by the invader. The defending party falls back on a new line of defence, and another stand is made there. But the invading hosts grow more powerful at each surrender of the opponent army. The vine-growers within the annexed territory begin to feel the stress of this state of war long before their conqueror does; they inveigle against their countrymen, who will insist in carrying on a hopeless struggle that is ruining one party without the chance of saving the other. They complain that the party which will carry war to a finish are ruining those who have been the first to suffer; that they will be utterly destitute if they are not allowed to protect their fortune as they think best. They must trade, they have replanted their vineyards with phylloxera-resistant vines; their commerce of vines, fruit trees, ornamental plants, &c., is fettered by this continuous state of war imposing so many restrictions on the people within the infected area.

Their voices grow louder as they increase in number. In the meantime, in every fresh issue of the *Government Gazette* new districts are handed over to the enemy, sometimes without first firing a shot, as

defence would be hopeless—at other times after a fierce struggle. Very often during one of these hard-fought battles the government army, for strategical reasons, had to adopt coercive measures against their own kinsmen of the defended territory. They had to destroy vineyards in their retreat to starve the enemy that is making rapid marches, and is ever at their heels: hence the outcries of those persons who found themselves between two fires, with attendant claims of compensation for losses sustained, their defection, their passing over to the discontented party.

In the general excitement and despondency there are not wanting charges of incompetence levelled against the generals of the defending army, of waste of the country's money, and many even aver loudly that the authorities are a lot of visionaries; that they are fighting a phantom enemy, which never existed except in the minds of the government officials who thereby make their livelihood. The government, finally, cannot shut ears to the clamouring of so many people. The central authorities waver; they must make some concessions; so it is advisable to alter the policy. Some of the most objectionable restrictions are removed, common action can no longer be reckoned on, yet the fight must go on, for the vignerons of the provinces still free will die hard; they at least will delay subjugation, and for some years yet will continue their pursuit in the old easy way; the while phylloxera makes great onslaughts, and the spectre of surrender is ever before their eyes.

Ultimately, the scourge conquered the whole French viticultural territory. Vignerons have submitted, but they can rightly say that the enemy was not allowed a walk-over.

The general loss was considerable—not less than 600 millions of pounds sterling. The output of wine in France had so greatly diminished that, to supply home consumption and keep the foreign trade, wines from Italy, Spain, and other parts of Southern Europe had to be imported. Wine being no longer cheap, as before, people took to spirits, so phylloxera opened the gate to alcoholism.

The onward triumphal march of phylloxera over the French territory filled with dismay the viticulturists of other States from the very initiation of the campaign. Soon they knew that the redoubtable parasite would outstrip the French boundaries, since it was plain that no European vines could offer enough resistance once it had penetrated among them. It was an international enemy, and the nations united in one bond to keep the enemy outside their national gates. In 1878, viticultural States sent their representatives to Berne, and a new holy alliance, offensive and defensive, was signed. The Berne Convention bound the treaty nations jointly and individually to certain measures—preventive ones, belligerent others. But all to no purpose. The Alps did not deter the victorious army, nor did the Pyrenees, and one after the other—Italy, Switzerland, Spain, Austria, Germany, and other countries—discovered that the enemy was within their gates.

The Governments of the respective States were prepared for the struggle; allied armies, each operating in their own territories, were mobilised without delay. Fire was set to the stronghold of the invader

to destroy its convoys, poisonous gas and liquids were pumped into the camps, beside a congery of stinkpots devised by the patriotic imagination of volunteers and indigenous versatile inventors, who are ever ready with a remedy against every national evil.

But phylloxera, like a myrmidon army, baffles all the tremendous efforts that science and a long-organised mobilisation can put forward; its progress continues, although somewhat abated; the onward march is delayed; but as soon as the vignerons begin to entertain bright hopes to have beaten back the enemy's legions, fresh incursions are heard of in distant places of the State, often hundreds of miles away. A fresh campaign must be started in those provinces, the defending army must be increased, new recruits are sworn, additional war material purchased, a number of old soldiers are withdrawn from the places where phylloxera is kept captive, and sent to form the nucleus of the new armies. The encroachments at different distant points of the States increase alarmingly, and the resources of the country are not inexhaustible. The army is split, the cordons kept round the enemy are thinner everywhere.

The campaign is conducted with mixed success in the allied States, according to their financial position, to the prowess and discipline of the defenders, to the climate and configuration of the territory to be defended. Those States which could offer less resistance, and have already large tracts of the territory overrun by phylloxera, have allowed the vignerons of those provinces to adapt themselves to the new *régime*, and on their behalf plead with the allies that some restrictions imposed by the Berne Convention be relaxed as far as those districts are concerned. After much parleying and persuasion, and threats of withdrawing from the Convention, some of the provisions are allowed to be altered, as it is still thought better to continue the campaign on an international understanding than if each State followed its own course. Besides, the wiles of phylloxera are now better known, and certain self-imposed disabilities are unnecessary. Such was the outcome of a fresh Convention signed at Berne in 1881. However, in France phylloxera has conquered all the territory of that nation, except a few small zones, lofty in their isolation, which the enemy cannot reach, as the intervening country is devoid of vines, and the enemy would, therefore, find no harbor, or food to live on, if it ever made the attempt to cross it. Prevailing winds either blow in the opposite direction, or are broken by some mountain range. Vignerons in their turn are sedulously watchful to prevent phylloxera coming in any Greek horse, which sometimes takes the shape of a guileless-looking post parcel, containing a few vine-cuttings, or vine-rootlings, of a new grape variety, that some collectors with exotic taste might import from a province where phylloxera quietly lurks.

The other vine-growing States are only partly infected; phylloxera holds some provinces wholly, in others it is gaining ground, although the governments are still engaged in beating it back. The results obtained are satisfactory enough, in so far as the march of the enemy is much delayed; thus many provinces are still free.

I adopted this war simile in briefly relating the actual conditions of viticulture in Europe, with regard to the worst foe of the great industry, because the fight engaged against it is carried on by all those concerned with the fervour of crusaders, and because on the principal lines it is much like the strategy and the tactics employed in expelling an invading army from a territory. Few, and only those who have fallen victims to the scourge, or take an intelligent interest in the subject, beside the Chancellor of the Exchequer of the nations affected, know, or can realise, the losses sustained, the energy and grit required in this war that has been waged for years. Epics of blood are recorded, everybody recalls the names of their principal heroes and victims; but how many do really believe that the wars waged against the enemy of the wealth of nations are no less worthy and holy than those fought for the triumph of national ideals. Lofty aspirations are dwarfed in the mind of a beggared, starving community, and a certain degree of economic ease is a necessary factor for the development and fulfilment of higher principles and for a higher conception of life.

How many really understand that the crusade against this scourge is directed to save a capital of one thousand million of pounds sterling already invested in France and Italy respectively? Who but a few realise what a powerful factor is viticulture in the settlement of a nation? Have not many of the stay-at-home Frenchmen emigrated from their fair country when phylloxera has rendered their viticultural territory barren, and have they not returned when a different system of vine-growing made it possible to continue the same industry? Is not the same happening in Italy, and other vine-growing States?

Virulence of the Parasite under different Climates.

It is natural that where phylloxera has more widely spread, and where special experimental stations for the study of its biology are at work, a budget of fresh information is from time to time made available which rectifies some facts, while others are added to the illustration of the life-history of the parasite and its relation to its host plant.

It was noted several years ago that, in hot climates, phylloxera was very often rather difficult to detect on the roots of the vines undoubtedly diseased if the inspection was made during the hottest months of summer. It was concluded that during this period of the year the insect was dormant (*æstivation*), as it was dormant at winter time (*hibernation*). The comparatively slower death of certain infected vineyards in hot countries and within a certain period of years is, in consequence, accounted through the fact that in such countries phylloxera would remain inactive during two seasons of the year instead of one, as is the case in more temperate climates. In many provinces of France where phylloxera would be dormant in winter time only, vineyards have been rendered economically unproductice in two years, and there are instances in Sicily, where first the *æstivant* period was noted, that have resisted longer. The general rule, however, still remains that a higher temperature throughout the year favours the

parthenogenetic prolificacy of the virgin mother insects, but if the summer temperature over-reaches certain limits, and is coupled with lack of moisture in the soil, the number of generations is smaller, and they may be even arrested, just as they are by cold weather. The two factors, great heat and dryness of the ground, must be concurrent, because casual showers in summer will soon revive the activity of the parasite with a certain degree of recrudescence. I have often noticed in my inspections of infested vineyards in Calabria, Sicily, and Sardinia that looking at the roots of some vines on which phylloxera had already been detected by my men, I failed to ascertain its presence, but returning to visit the plants a few days after a shower of rain, the insects were more easily detected.

Prophylaxis of Phylloxera.

The prophylaxis of phylloxera is confined to prevent its introduction into a territory. All restrictions against importing vines from an infected country into a clean area are prophylactic measures. The compulsory disinfection of vines before removal is of the same order, and important work has been done in this direction. The disinfection of vines through hydrocyanic gas, or by vapours of carbon bi-sulphide, or by dipping them in a solution of 1–2 parts of potash cyanide per 1,000 of water or in a solution of potash sulpho-carbonate or of lysol, and other systems are now being substituted by that of keeping for five minutes, either cuttings of rootlings in water at the temperature of from 50°–53° degrees centigrade equivalent to 122°–127·4° F. Balbiani proposed the latter method several years ago, which having recently received fresh sanction by further exhaustive experiments, is now more largely applied.

As far back as 1887 Messrs. Henneguy, Couanon, and Salomon found that vine-cuttings kept for ten minutes in water at 122° F. would strike in the proportion of 89 per 100, which they consider is the ordinary mean for non-disinfected cuttings.

Inspector Danesi (Department of Agriculture, Rome), in 1899, repeated the same experiments, and kept vine-cuttings for ten minutes in water from 122° to 125·6° F., viz., 50°–52° centigrades, and *all the cuttings* so treated rooted well.

The resistance of rootlings to hot water was also tried by the above-named gentleman. Vine-rootlings were dipped in water at 53° centigrades = 127·4° F., and kept five minutes; when they were taken out, the temperature had descended to 51° centigrades = 123·8° F. These rootlings having been planted, all took and grew well.

Signor Danesi furthered these experiments by ascertaining the maximum temperature of the dip that cuttings and rootlings will stand. So he found that their vitality is in no way impaired by a temperature of 58° centigrades = 136·4° F., but that between 58° and 60°, viz., 136·4° = 140° F., the tissues in many cases would be affected and some cuttings or rootlings would be killed. Generally, rootlings stand these high temperatures of the dip better than cuttings. *Riparia Gloire* is affected sooner than the *Rupestris du Lot*. Many

cuttings at the time they were dipped were far advanced; their buds were well swollen and nearly ready to open into leaves, yet the hot-water treatment did not affect them.

Phylloxera-infected rootlings were disinfected by keeping them for five minutes in water at 53° centigrade. When they were extracted the temperature had descended to 52·4° C. With them a vineyard of mother stocks was planted in the island of San Domino—group of Tremiti—and after consecutive inspections having found them free of disease, the wood was distributed to twenty-four districts viticultural stations in Apulia, which is seriously menaced by the scourge.

* Inspector Danesi told me in Rome that he had also tried disinfection with a solution of copper sulphate 2 per cent. strong, and he succeeded in destroying all traces of phylloxera.

This treatment would then serve the double prophylactic purpose, viz., prevention of phylloxera and that of many fungoid diseases.

(*To be continued.*)

Green Manures for Vineyards.

At the Howlong Viticultural Station, and at several large vineyards of many years' standing in the Riverina district, the Viticultural Expert has conducted for several seasons experiments to demonstrate the benefits to be derived from the practice of green manuring for vines. Leguminous crops, such as field peas or vetches, are sown with mineral fertilisers late in March, and are ploughed under just as the pods are forming, which is generally about August. The owner of an 80-acre vineyard in the Albury district was so well satisfied with the results of his first experiment in this method of restoring the productiveness of his vineyard, that he has systematically followed it each season since with excellent results, both as regards the quantity and quality of his yield, and in the improved mechanical condition of soil.

Fishy Butter and the English Market.

M. A. O'CALLAGHAN.

REPORTS from London regarding the prevalence of a fishy flavour in Australian butters have been both numerous and frequent during the current shipping season. This is to be regretted, because, owing to the fact that Australian butter was practically absent from the London market last year, merchants handling this produce would have found it difficult to get full value, even though the quality was first class, but with the presence of this fishy flavour in some of the best known New South Wales and Victorian brands, the difficulty in maintaining anything like a full value price has been rendered almost impossible. Three years ago our best brands of butter averaged, say, from 6s. to 10s. below that of best Danish, whereas this year there is a difference of almost 20s. per hundred between the selling prices of Australian and Danish butter. This is difficult to explain, and no doubt more than one cause is responsible for the result. To begin with, Australian butter was almost unrepresented on the London market last year, and hence the trade connection was temporarily severed, and in order to induce business again specially low prices had to be quoted by sellers of Australian butter. The second and perhaps the greatest cause of this great discrepancy in price between Australian and Danish butters has been the shipment from Australian ports at the opening of this season of butter, which had been held in store either in Sydney or Melbourne for some months. This butter had become inferior, and its shipment to England at the beginning of the most promising season which Australia has experienced for years was calculated to do more injury to Australian producers than anything else we can think of. This butter was never made for export, to begin with. It was made by factories in a year of scarcity when there was very little talk of grading cream, the butter being intended for local consumption, and in the ordinary course it would have been used up in a few days after the date of manufacture. Competition for cream by factories was very great, and the competition for butter by the produce agents was also very keen, and under these circumstances it was not surprising to find that most factories mixed the creams of all comers together, irrespective of the different ages of the various creams. This could only have one result, namely,—an inferior butter, possessed of no keeping qualities. A good deal of the cream that went to manufacture such butter, was undoubtedly fishy on its arrival at the central factory, and when the butter made from this mixed cream was placed in the cold store, there could be but one result, namely, that this butter would develop a fishy flavour in a few weeks. Some holders of these stored butters endeavoured to place them on the Sydney and Melbourne markets towards the end of winter, but it was

impossible to sell them except at pastry prices, and as a consequence they were despatched to London bearing the brands of the factories where they were manufactured. When these butters were opened up in London, they in most cases were extremely fishy, the result being that London buyers held off, and sales could only be effected at prices representing a considerable loss to the holders. In time, however, this butter got distributed throughout the country, and before the new season's Australian butter was placed on the London market, the English consumer had a very nasty taste in his mouth, and thus it was not surprising to find that when freshly made butters were placed on the market the English merchants kept a sharp look-out for anything with a fishy flavour. Their watchfulness was not unrewarded, for some well known New South Wales and Victorian factories were set aside as being fishy. As showing how the stored fishy butter affected the sale and reputation of this season's arrivals, Mr. Lance, in a recent letter to the Minister for Agriculture, quoted an instance where a butter merchant in a country town who had purchased New South Wales butter from a London house at top price, found it on arrival to be a brand which had been quoted to him by a competing house at 10s. less than he had paid for it. He demanded an explanation from the London agent, who had some difficulty in persuading him that the brand of butter, though made in the same factory, which was quoted 10s. less, was really twelve months older than that which he had sold him. With such experiences as these it is not surprising to find that complaints regarding fishy butter are more numerous this season than they have been during any previous year; in fact the watch on Australian butter is so close at the present time that it is impossible to pass off anything, even slightly inferior, on the wary grocer.

The cause of Fishy Butter.—In previous issues of the *Gazette* I have given the full history of the cause and means of prevention of fishy butter. The cause is a small mould known as *Oïdium lactis* growing conjointly with the ordinary organism which causes the souring of milk. This mould which causes so much injury to our butter makers is commonly found in old or stale milk, showing that milk and cream might be considered one of its chief habitats or homes; therefore if farmers have to avoid growing this organism in great numbers on their premises, they must do away with all its receptacles in which old decomposed milk is kept. It is a common thing to find what is called the "pig tub" just outside the dairy door wherein the cream is kept at the farmer's home. This pig tub is used for receiving the surplus separated milk and separator washings, and is partly emptied each day for the purpose of pig feeding; but unfortunately it is rarely or ever thoroughly cleaned, the result being that a breeding-ground for undesirable organisms is constantly kept close to where the cream is being held.

From practical experience I can also state that a common habitat of this mould is found in old timber buildings. Dairies with timber roofs, without ceilings, that are not frequently washed with quicklime, or some disinfectant, are common centres of infection. There need not necessarily be any bad smell about the premises. This mould

resting on old timber slabs bespattered with milk or cream will not cause any noticeable smell, but the spores or seeds will fall into the cream, and, in due course, cause trouble, and when a district becomes thoroughly infected, the good dairymen often suffer with the bad. Like most microbic troubles, human and otherwise, this butter disease may be very spasmodic. It may crop up in districts where it was never heard of before, and it may disappear just as suddenly as it came, to recur again at a favourable opportunity. This being a moist season has been particularly favourable to spread of fishiness.

One of my field assistants has been inspecting a number of dairies recently that supply fishy cream to a factory, and his report on their condition should be of much interest :—

Sir,

I beg to report that during the week ended February 6th I have visited the following factories and dairies :—

February 1—In Central Factory cream-grading, &c.

February 2—In factory in the forenoon, and at Messrs. M.'s and T.W.'s dairies in the afternoon. The cream from these two were on my list as "fishy." M.'s dairy is 9 x 10 feet, made of brick, has concrete floor and T. and G. board ceiling, is fairly clean. A couple of shelves in it are greasy with cream, but there is no smell, and the surroundings are fair, but the cream is not cooled. T.W.'s 10 x 12 feet, brick floor, never washed, only swept, sides, rough wooden slabs, and ceiling slabs ; the whole limewashed (but not recently), two boxes for standing the cream bucket on while separating were very dirty and greasy from cream and milk having continuously been spilt on them. The separator and surroundings were very greasy with oil and there was a distinct oily smell about ; the cream was cooled by setting in water.

February 3—Mr. M.'s separator room is about 6 feet x 10 feet in part of an old hut, with shingle roof, which is black with age ; the floor is about 18 inches off the ground and open in the joints, and a smell arises from under the floor. The separator is a horse-power one ; the tank supplying milk to the separator had a bit of rag in it to stop a leak, and there was some decomposed milk about the corners and edges of the tank. The cream is not kept in this room but is removed to another one close by. The separator room is not a room for milk and cream to be exposed in ; the room the cream was kept in is about 6 x 8 feet and ceiled, but is close and stuffy, and it is also off the ground and the flooring is of board. The milk from the separator is run into cans at the door of the separator room and this place was very offensive. The pigs and fowls were round the dairy and all over the place. A piggery is under construction about 50 yards away, but the present piggery is only 20 yards away. The whole place is a most unsatisfactory one from our point of view, and I consider it should be condemned as unfit for the purpose. Mr. R.'s, 12 x 12 feet, rough wooden slabs, T. and G. floor and ceiling, the latter open in places and never limewashed, otherwise the dairy looks clean ; a pig tub kept outside was very offensive. Mrs. J. R.'s, 7 x 9 feet only, lined and ceiled and limewashed, neat and clean, but close. The only ventilation was an opening 12 x 12 inches, covered with perforated zinc. The surroundings were good. Mr. G.B.'s, good and clean (not a fishy one).

February 4—Mr. B.'s and Mr. F.'s both on the fishy list. Mr. B.'s about 9 x 11 feet, floor concrete, dry and clean, very low to roof ; only in the centre could a person stand upright. The roof is bark, no ceiling ; the surroundings are good.

Paddock-fed Pigs.

By W. H. CLARKE.

On several occasions, reference has been made in the *Agricultural Gazette* to the advantages of pig farming on the paddock system. It is encouraging to note that several farmers have given a fair trial to the system of a rotation of pasture crops, as outlined, and one of them has stated that his income for a year was £700. It is possible that many others have also done well, because the class of bacon that can be made from healthy paddock-fed pigs has been selling in large quantities at 1s. 3d. per lb. retail, and in the city yards, for many a long day, good baconers and porkers have ranged from £2 to £3 10s. a piece. Swine fever and shortage of feed on dairy farms and maize farms, where pigs are mostly raised at present, may certainly have had an important effect on prices; but that cannot alter the fact that for years, and even when beef and mutton were at extremely low prices, pork never got much below 3½d. per lb. live weight, either at the bacon factory or butchers' yards. So far as swine fever is concerned, it is simply the outcome of filth. It may certainly be introduced into a clean herd; but where pigs are kept on the paddock system, the healthiness and cleanliness of their conditions do not give disease of any kind much chance to take hold or to spread. In America, where pig farming on the paddock system is almost general, enormous losses occur through hog cholera; but it must be borne in mind that for at least three months in the year the severity of the winter is such as to necessitate the confinement of pigs in styes, and under such conditions, naturally, it is an extremely difficult matter for the farmer, whose most available building and flooring material is wood, to ensure the perfect cleanliness that is essential. In New South Wales there is not any necessity to absolutely confine pigs to styes at any time of the year. Under the paddock system suggested, the only time the pigs would be confined in yards would be during the month or six weeks of special hand-feeding to complete their topping-up for market. Brood sows and youngsters would be grazed out all the time, obtaining the necessary shelter in cheaply-built little sheds in the paddocks. As to the *modus operandi*, the plan previously suggested was to set apart an area of the best land on the holding, choosing if possible a tract traversed either by a creek or a natural depression, which could be utilised for a water supply for each of the long, narrow paddocks into which the area would be divided. Say it were possible to secure 10 acres. The ease and economy with which the pigs could be managed and provided with food would depend upon the number of strips into which the 10 acres could be subdivided. The ideal would be ten paddocks. Now, let us see what it would cost to fence a 10-acre patch into ten paddocks of 1 acre each. A pig-proof fence, under ordinary conditions of suitable timber for a three-rail being on the ground, and barbed wire costing about 15s. a cwt., would in all probability cost at least £35 a mile.

The outside fence around the 10 acres (assuming the area to be square) would be half-a-mile. The nine division fences necessary to partition off the ten paddocks would be $1\frac{1}{8}$ mile. So that the cost of fencing would be for $1\frac{5}{8}$ miles, which, at £35 a mile would cost, with gates, about £60. Another £50 would erect all the snug little shelter-sheds in each of the ten paddocks, or, by an easy arrangement, one shed could be made to serve two paddocks by means of a gate to shut off whichever area was not being grazed. With ten paddocks, and three of them laid down to lucerne, it ought to be possible to carry at least 100 pigs of all ages right through the twelve months, and at certain seasons thirty or forty more. As time went on, the areas would naturally carry more pigs per acre than at first, when the primitive sourness of the soil and want of texture tend to produce irregularities of growth. Moreover, where fifteen pigs can find a month's food foraging and roaming at large over an acre of maize and cowpeas, a considerable portion of which they destroy by trampling, half as many more could be comfortably quartered for the same time on the same area of crop, when, by the adoption of narrow paddocks, it is easy to restrict their vandal wanderings by means of hurdles only 1 chain in length. If the hurdling is always commenced nearest the water, there will not be need for the person in charge to waste time watering the animals.

As an actual example of the manner in which a large number of pigs can be provided for on a small area of even one crop—lucerne—the writer directs attention to the following plan of a Kansas pig-farmer, who makes 30 acres of lucerne, in three paddocks of 10 acres each, carry 300 pigs for seven months of the year, as described by Mr. Geo. L. Clothier.

PLAN of rotation on 30 acres lucerne (without irrigation), subdivided into three paddocks of 10 acres each.

Dates.	Paddock I. 10 acres.	Paddock II. 10 acres.	Paddock III. 10 acres.
April	150 head young pigs ..	Rests during April	150 head adult pigs.
May . ..	150 head adult pigs .. .	150 head young pigs ..	Rests during May.
June	Mown and rests during June	150 head adult pigs	150 head young pigs.
July	150 head young pigs	Mown and rests during July	150 head adult pigs.
August	150 head adult pigs	150 head young pigs ..	Mown and rests during August.
September ..	Mown and rests during September.	150 head adult pigs	150 head young pigs.
October . ..	150 head young pigs	Mown and rests during October.	150 head adult pigs.

It will be noticed that the youngsters are given the advantage of the tenderest growth following the mowing and spell. In the winter and early spring months of November, December, January, February, and March (in Kansas), the pigs have to be housed and fed a ration of grain, to which the hay saved in the mowings of the lucerne plots is a valuable supplement. In New South Wales the seven months enumerated in the above plan would comprise from, say, September till March, but in our climate lucerne could be relied upon for at least another month, and we have so great a diversity of crops which can at their respective seasons be so cheaply produced, that there would be little or no necessity to depend, even for seven months, on lucerne

alone. All the same, this working plan shows what really can be achieved in the systematic practice of rotative pasturage.

There are a number of people possessed of a few hundred pounds who are desirous of embarking in some form of agricultural enterprise which will return a fair profit, and in course of years produce a competency. To such of them as care for a rather bustling occupation, in which it is all the time a question of good profits from quick returns, pig farming on the paddock system can be earnestly recommended. It is a business totally unsuitable for any one who is in the habit of leaving anything to chance, or who has not a methodical turn of mind. It is a *sine qua non* that the area selected for the purpose of a paddock pig farm should consist of live soil of the best quality, such as can best be discovered by the man who takes a swag on his back and carefully plods through the tract of country lying between Port Stephens and Richmond River, or will be obtainable in some of the hot, dry districts when irrigation facilities are provided. Extensive swampy tracts and low-lying sodden areas look very nice and promising in midsummer; but when a man has a lot of lusty porkers to feed, he requires a soil that things will jump a bit in. Cowpeas are a splendid food for pigs. But there are lots of places subject to late frosts and all sorts of discouraging influences, where the spring-born piglet would die of old age before he got a taste of the crop sown to celebrate his birth. In lots of heavily timbered country one may come across what appear to be ideal places for even market gardens; but when, at infinite expense and years of toil, the timber is got rid of, all the crops get sleeping fits every now and then, and a cropping of maize that should have been harvested in three and a-half months is, at the expiration of four months or so, about a foot high and as yellow as a duck's foot. These remarks are made merely to indicate that anyone without some practical knowledge of agriculture, and soils in particular, cannot go straight out and pick at first pop an area well adapted for so lively an undertaking as pig-farming on the paddock system. But by availing of all the facilities the Lands Department can extend, and of all the advice and assistance the Experts of the Department of Agriculture can offer, there is no reason why a man who seriously sets about the business should not be able to secure an area possessed of the necessary qualifications. He will have to go to some trouble to secure it. So he would if he wished to start a grocery or any business anywhere. The man who starts his shop on the wrong side of the street is only doing the same as the farmer who establishes his plantation on the wrong patch of soil. When a person gets on the right bit of soil, practical experience is a good thing to be possessed of; but, as a matter of fact, "practical experience" is such a various kind of thing, and there are so many different degrees of it, that the novice who is ready to learn and to exercise common sense, will be as successful in the production of crops as some who have lived on the land all their lives.

In next month's issue there will be commenced a series of articles by Mr. H. W. Potts, Principal of the Hawkesbury Agricultural College, dealing with every phase of pig-breeding, rearing, feeding and management.

Some Questions for the Wheat-grower.

W. H. CLARKE.

It goes without saying that every wheat-grower aims at getting the best possible return for labour and material expended in the production of his crops, but when one comes to consider the many ways in which losses may be incurred altogether apart from those for which unfavourable conditions of the growing season may be accounted responsible, it seems pretty clear that there must be an enormous amount of work done every season for which the grower receives no return.

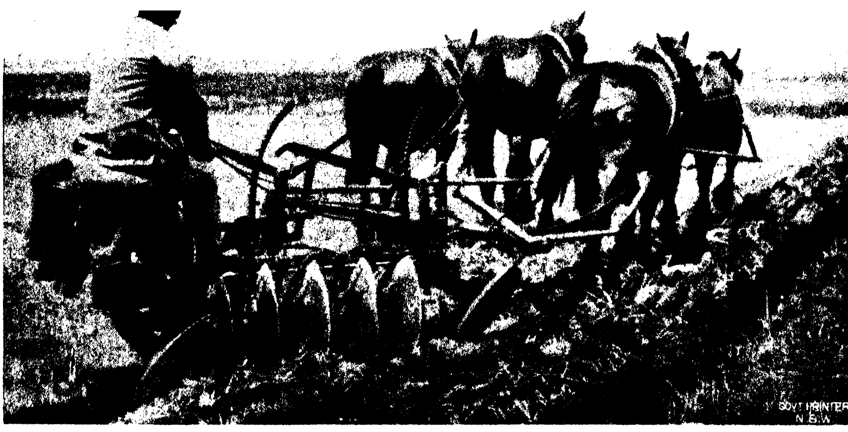
For the purpose of illustrating the points which it is now proposed to take into consideration, the experiments conducted by Mr. McKeown at the Wagga Experimental Farm on acreages sufficiently large to demonstrate the commercial aspect of the matters referred to will be utilised. These experiments will serve, perhaps, better than any others in a general discussion, because the Wagga soil and climate is fairly typical of a very large proportion of the State in which wheat is regarded as a main crop.

In good seasons no less than in adverse years the placing under cultivation of a greater area than can be properly managed in every essential detail is responsible directly and indirectly for losses in crop and for fruitless expense. In districts where wheat is most extensively grown it is not always practicable for a farmer to turn to the moment his crop is off the land and plough it up, as some farmers in more favoured districts can do, in readiness for the ensuing season. All the labour and teams he can command are fully occupied after harvest in hauling the crop to the railway, and by the time that job is finished the wheat paddocks will generally have dried out and the soil have become as hard as a road. Even if the ploughs would take the soil at such a time, there would be little economy in it, because the lumps turned up would require expensive harrowing to reduce to a tilth fine enough to form a good seed-bed. Thus it will be seen that if the farmer aims to prepare his land cheaply he must be in a position to be able to defer his ploughing until rain comes to soften the soil sufficiently to enable the ploughs to reduce it to a fine state of division. And to be in such a position it is absolutely essential that the area must be kept well within the capacity of the teams and implements at command, so that if the wait is a long one the wheat-grower will not be forced to either scamp over the preparation of his seed-bed or sow his seed late. Of the two misfortunes, late sowing is the worse. There are seasons when wheat sown in land prepared anyhow, but sown opportunely, may do splendidly, but in all the range of years from drought to plenty there is none in which crops sown out of season have done anything like their best. At the

Wagga Experimental Farm and on many private holdings in all the principal wheat districts of the central and western divisions experiments and commercial routine have demonstrated times without number that early sowing is nearly twice as profitable as late sowing. Of course, when such a statement is made, readers will understand that it is not inferred that every variety of wheat in every district of the State should be sown early. There are varieties of wheat requiring but a short length of time to attain maturity, but they have not yet been proved, on a money basis, to be worthy of first consideration in the great wheat-belts.

Ploughing.

At the Wagga Farm the rotary disc plough is used, and it is found that by means of this implement the breaking up of the soil can be accomplished at a very small cost as compared with mould-board ploughs. The work that it does in dry stubble soil is shown in the accompanying illustrations. In this paddock the lands are 30 chains in length, and the cost of ploughing is slightly over 2s. 4d. per acre,



which is the price at which 60-chain lands are ploughed in the Experimental Farm. The accommodation for students at the Farm is now taxed to the utmost limit, and, to afford all the lads a good chance of getting a practical insight into all farm operations, it is necessary to go on with the ploughing at times when in ordinary farm practice it would not be considered desirable to do so. If the soil shown in the illustration had been moistened by a day's rain, the discs would have left it as fine as a forked garden soil, and the odd scraps of stubble that are now to be seen on the surface would have been turned clean under. There is trouble in places where a crop has laid

Disc Ploughing at Wagga Farm. The soil in this case was in good condition.

or among the tangled straw left by the stripper in getting the discs to thoroughly turn under all the vegetable matter. Like all machinery and implements, rotary disc ploughs are more efficient in the hands of some men than with others.

At the Wagga Farm the seed and fertiliser drill is preceded by the smoothing harrow. When the ploughing has been done under favourable conditions the surface is in sufficiently good tilth for even working of the drill, and the smoothing harrow may not be an absolute necessity, but where wheat is grown for experimental purposes uniform germination is always aimed at, and the harrowing, which costs a very small amount per acre—about 3d.,—is considered to be desirable.

The advantages of Early Sowing.

The advantages of early sowing are that better results can be obtained from half the quantity of seed than is required later in the season, as the early-sown plants stool much more heavily than late sown. They also become better established before the heat and drying winds set in, and, therefore, do not suffer to the extent that late-sown crops do, as the latter have not time to admit of proper development of their root-system, and, naturally, cannot avail as fully as more forward plants of the moisture and plant-food deep in the soil. An early-sown crop has thus a better chance of resisting hot winds and unfavourable conditions, with the added possibility of ripening sufficiently early to avoid the adverse weather that is often experienced in the early summer. In a spring favourable to the spread of rust the advanced crops suffer least injury, and where caterpillars are destructive there is the advantage in early-sown crops of the straw being too tough at the time of infestation for the insects to do the crop much damage.

For grain, sowing in April and May is to be recommended; for hay, March or early in April.

The advantages of Good Seed.

When a wheat-grower has plotted and planned to prepare his area as thoroughly as possible, and has done everything that possibly could be done to procure a perfect seed-bed, it usually means that he is out of pocket, directly or indirectly, a good 5s. an acre or more. If he is going to use some fertiliser, that will mean an additional 2s. 9d. or so an acre, and surely there is not much sense in preventing that 7s. or 8s. an acre from multiplying, by sowing a measly lot of chick wheat. The exact scientific experiments of Dr. Cobb, the broad acreage demonstrations of the managers of Wagga Farm and Bathurst Farm, and the experience of the best and most successful farmers from Adam downwards, all go to prove beyond any but captious doubt, that, while shrivelled seed and nondescript screenings may, under favourable conditions, happen to produce fair crops, uniformly good seed will produce better, and what is more important, crops that will contain a greater percentage of first-class selling grain. Another advantage that follows the use of graded seed is the general evenness of the crop

in growth and maturity. This is best appreciated by those who use strippers, and if one were to carefully investigate the matter, it would, in all probability, be found that besides the increased difficulty of handling an uneven crop, there is also substantial loss from the heads on the stunted plants from puny seeds being missed by the combs of the stripper.

In speaking of the advantages of early sowing, reference was made to the fact, that by means of early planting with the drill, a saving of 50 per cent. of seed could be profitably effected. Under such circumstances, it would appear to be sound business to use the best seed procurable. In this *Gazette*, the question of seed-grading has been very fully discussed, and as the result of many years' careful experimentation at Wagga Farm, and observation throughout the principal wheat-producing countries of the world, Dr. Cobb states that the advantages of large, plump, graded seed are that—It is likely to be healthier seed, and therefore more likely to produce healthy plants. It can be sown more evenly because of its uniform size. There is a larger percentage of growth, and fewer failures. The plants from such seeds are larger and thriftier and more resistant to disease, drought, and starvation. The crops from such seed have a more even growth, and are more economical to harvest and thresh. The yield per plant, both of grain and straw, is greater from such seed. The crop of grain grown from such seed has a higher market value, because—*(a)* It contains more large grains and fewer small grains; *(b)* it is plumper and better looking; *(c)* it weighs more per bushel. The continuous use of such seed tends towards a general improvement in the quality of wheat.

This is exactly the case in the large paddocks of wheat now grown by Mr. McKeown, who has a grading machine, capable of treating, at trifling cost, all the seed wheat required for distribution and sowing at the farm.

The importance of Careful Sowing.

When lack of time or other circumstances have prevented proper preparation of the land, and when the seed has been of poor quality and sowing late, one can easily account for the crop so grown on one farm falling short in yield by several bushels of that obtained on an adjoining farm and comprising similar soil, and exposed to practically the same climatic conditions. But when on both farms good seed is sown opportunely in perfect seed-beds, and both crops are harvested about the same time and by the same kind of machinery, and then the yields differ, we have to look around for the cause. This, Mr. McKeown considers, is very often due to bad driving on the part of the person in charge of the seed-drill. The drill has thirteen tines, and some drivers in manipulating the team miss a tine row in every round. That is, they leave unsown one row in every thirteen, which means about 8 per cent. of the total area. Then sometimes a driver may occasionally allow the horses to swing out and miss a strip of, perhaps, a couple of tines' width, or a lot of space at the turns may be missed, and it is possible in so monotonous an operation for a driver seated on

the drill to become dozy and miss here and there spaces that may total up to 10 per cent. of the area without being aware of it. The remedy is for the driver to walk or stand on a board fairly in the middle at the back of the drill, so that he does not get inattentive or miss a drill through not being able to see where his wheels are going or what the drill is doing. Instances are known where it has been necessary, after the crop has shown up, to go over the paddocks and broadcast the spaces that have been missed by the drill, and this source of fruitless labour which it is possible many growersa do not regard as of very much importance may be responsible for a loss of 100 bushels in every 1,000.

As to the question of drilling *versus* broadcast, the experience at Wagga is that there is in the ordinary run of seasons a difference of nearly 2 bushels per acre in favour of drilling.

The use of Fertilisers.

At the Wagga Wagga Farm exact experiments are being carried out by Mr. F. B. Guthrie, Chemist to the Department, to determine the effects of a large number of manures, alone and in combination. Of necessity this work has to be done in small areas, but in the large paddocks, where the crops are grown to demonstrate the productiveness of varieties, and the effectiveness of various methods of cultivation and harvesting on a commercial scale, experiments have proved that eminently satisfactory monetary results are obtainable by the drilling in with the seed of 60 lb. per acre of superphosphate, which costs on the farm 2s. 9d. per acre.

On millions of acres of the wheat districts of New South Wales the soil is naturally rich enough to produce under favourable rainfall large yields without any manure being applied, an occasional spell, such as the land gets perforce in severe drought, or alternate cropping and grazing or fallow, being sufficient to enable it to produce, as thousands of acres have done during the last season, big returns. But farming under such conditions is leaving too much to chance, and it is being shown in nearly every district of irregular rainfall that a more certain return can be assured by the practice of drilling with the seed a small quantity of artificial fertiliser to push the crop around critical corners. A man with 500 acres to manure may look a long time at the 70 or more pounds sterling that he is recommended to bury with his seed, but increased yield on the one hand and the risks of losses earlier ripening enables him to avoid on the other, are convincing arguments. Hundreds of farmers who have visited the Wagga Farm to see for themselves what is being done in connection with the use of manures on a scale within their own reach, have expressed themselves as being satisfied that the two or three shillings per acre's worth of fertiliser pays.

A farmer near the Wagga Wagga Farm gives a striking case of the value of manures as used on the 2s. 9d. an acre basis. He tried this fertiliser (60 lb. per acre) on half his area, and got 24 bushels per acre return, and left the other half unmanured, from which he harvested 14 bushels per acre.

Leakages in the Harvest.

In a number of paddocks in which the stripper had been used the writer noticed large numbers of heads of grain. In one paddock they were so conspicuous as to excite a doubt as to whether the

Harvesting Wheat at Wagga Farm.

machines had actually been through the paddock at all. In discussing this matter the Manager of Wagga Farm stated that, so far as his experience enabled him to form an estimate, the practice of stripping,

Students engaged in threshing Wheat at Wagga Farm.

unless the crop is perfectly grown and weather conditions are ideal, is responsible for very considerable losses. In the first place, there is a direct loss in the weight of grain—reaped, stacked, and threshed grain is said to be about 10 lb. per bushel heavier than stripped

The stack-yard at Wagga Farm. The straw stacks have not yet been trimmed and thatched.

grain. This is due to the fact that whereas a crop can be reaped in its prime, and the grain left to mellow in the stack, for stripping the crop must be left until it is dead ripe, and then unless it can be all dealt with immediately an enormous quantity of the grain may be threshed out by wind, or it may become bleached by rain, in addition to losses incurred through missing by the combs of the stripper of stunted and laid stalks. Mr. McKeown quoted one instance of a farmer who had one-half his area reaped and the other stripped. The stripped half returned two bags per acre less grain than the reaped, although to all appearances the two sections were equally well grown. The manager also cited a case in emphasis of his contention as to the unconsidered losses involved in the system of leaving the crop until the grain is dead ripe. A farmer, on a Saturday morning in November last, went into town to order 1,000 bags for the reception of his grain. On the Sunday there was a violent wind-storm, which clean threshed out the crop, and on Monday the farmer had to countermand the order for the bags, not one of which was then required. A good many farmers prefer the stripper, because they consider it is a cheaper means of harvesting than the reaper and binder and threshing. It certainly has a good many advantages in the matter of speed, and the fact that it offers a straight-ahead, ready

means of getting the grain into market form makes it attractive to many wheat-growers. All the same, this principle of harvesting cannot stand comparison with the roundabout system of reaping, carting, stacking, and threshing, as the following figures supplied by Mr. McKeown will show.

In 1901 an area of 45 acres at the Wagga Farm was sown for the purpose of demonstrating ten different methods of cultivation, such as quantities of seed per acre, quantities of manures per acre, broadcast *v.* drilling, and other points of practical value. The harvest ranged from 18 bushels to 27 bushels 54 lb. per acre, with a total yield for the 45 acres of 994 bushels. The wheat was sold for milling at 2s. 9d. a bushel.

The actual expenditure in working the 45 acres was:—

	£	s.	d.
Ploughing, harrowing, seed, manure (ranging from 1s. 3d. to 2s. 9d. per acre), drilling, and broadcasting seed ...	19	11	2
Cutting weeds out of headlands ...	2	5	8
Harvesting, including reaping, carting, stacking, and threshing ...	41	15	0
Twine ...	3	14	0
Oil ...	0	9	5
Sacks ...	6	7	0
Making a total cost of ...	£74	2	3

The returns were—

	£	s.	d.
994 bushels wheat at 2s. 9d. ...	136	14	4
Straw valued at £1 per ton ...	57	12	0
	£194	6	4

leaving a balance of £120 4s. 1d.

On a farm where the stripper only is used the working of such an area—assuming that there was no loss of grain by shedding, bleaching, or missing, and that the farmer's hands worked eight hours a day, and were paid at the same rate as the Wagga men are, the figures would be:—

Expenditure.	£	s.	d.
Preparing and sowing 45 acres, as above ...	19	11	2
Cutting weeds ...	2	5	8
Stripping at contract price, 8s. per acre ...	18	0	0
Oil ...	0	9	5
Sacks ...	6	7	0
Making a total of ...	£45	13	1

While the farmer's returns from the stripped crop would be—

	£	s.	d.
994 bushels of wheat at 2s. 9d. ...	£136	4	0

leaving a balance of £91 1s. 1d., as against the £120 4s. 1d. in reaping, so that even under perfectly equal conditions the reaping and threshing method is about 12s. per acre more to the good. But the advantages by no means end with this higher monetary return for the grain. The supplies of straw that are thus made available for fodder for stock in conjunction with more concentrated foods, or for sale in times of scarcity, render the position of the farmer infinitely more secure. For instance at Wagga Farm for three seasons the straw saved was beyond actual requirements, but as it was stacked carefully and snugly thatched, it remained in first-class condition until

there was a big demand for straw. Then the manager was able to dispose of his three years' accumulation in the shape of chaff which yielded a net cash return of £935—an amount sufficient to pay for a complete reaping and threshing plant and engine over and over again.

This season the straw is stacked straight from the elevator of the thresher, and the "cocky chaff" is also saved, with the result that there are now huge stacks of reserve, stand-by fodder for use on the farm or disposal in a season of scarcity. It may not be required for years, but there it is as a valuable asset that cannot depreciate much in value.

Wheat for Hay.

Nearly every farmer in districts like Wagga will find it a good practice to grow a fair area of wheat for hay, because disposal of the crop in that way is often more profitable than grain under ordinary conditions. The Sydney buyers prefer hay grown in the Riverina climate to that from moister climates. The straw of wheat grown in the latter districts is thin and spongy to an extent which is not noticeable at Wagga, where at harvest time the weather conditions usually permit of perfect curing in an attractive and palatable state. Rains come as a rule early in October, and probably those who start harvesting then may be hindered a bit, but generally the weather conditions are good, and if the wheat is cut in a green condition, about the flowering stage, a hay of better weight, more palatable and digestible qualities, and more attractive appearance may be made than is possible by leaving it, as so many farmers do, until the grain is well filled, in the hope of securing increased weight. For hay at Wagga Farm white wheats are preferred to purple straw varieties, because hay from the white varieties is better liked by stock, and they make far less dead flag, and produce taller growths of straw, which weighs better in proportion to other hay.

The following are some of last season's yields at the Farm :—

	Hay per acre.		
	cwt.	qrs.	lb.
White Lammas	52	0	19
White Essex	64	0	22
White Tuscan	52	3	4

An area of 11 acres, Berthoud, gave 50 tons, while from an acre of Australian Talavera 3 tons hay was obtained.

Last season there were in all 225 acres sown for hay. A patch of about 6 acres was destroyed in April by water flowing over the land. From the balance 620 tons of hay was made, and 100 tons of wheaten ensilage.

As an instance of the profits of hay-culture, in 1902, an area of 155 acres was sown for hay. The bulk of the crop was cut into chaff and sold in Sydney with a net return of over £4 an acre. In 1901, a 90-acre paddock yielded a crop, which at 55s. per ton offered in stack, showed a profit of over £5 an acre. The present crop of hay will cost about £2 per acre—that is, equal to 13s. per ton of chaff, and the cost of marketing from Wagga, including freight, sacks, cartage, and all city charges, is about 35s. per ton, so that anything over 48s. per ton in Sydney would be clear profit.

Cutting Chaff.

In cutting chaff a length of one-half to five-eighths of an inch or over is desirable, as the principal buyers prefer it cut that way. A farmer operating near the Wagga Farm recently topped the Sydney market with chaff cut precisely as it is cut at the Farm.

Barley.

One of the difficulties in the production of barley in a district like Wagga is the uncertainty of rain just towards ripening time, and the grain in consequence is apt to be irregular. For malting purposes, buyers prefer an even grain, and to meet this requirement, it is necessary to go to some expense in grading the grain.

As an index to the commercial returns from barley growing at Wagga, Mr. McKeown applies the following figures:—

In 1900—

	£	s.	d.
90 acres barley returned 1,900 bushels, which realized ...	219	7	6
Straw	21	0	0
	240	7	6
The total cost of growing, harvesting, and marketing came to	126	10	9
Leaving a balance of ... ... for the 90 acres.	£113	16	9

In 1901—

	£	s.	d.
27 acres barley yielded 949 bushels, which sold for... ...	£157	17	3

Included in the working expenses of that paddock there was a small area of hay which returned £30 5s., and the 14 tons of barley straw from the 27 acres was worth £14, so that, with cost of production and all expenses amounting to £132 14s. 6d., there remained a balance of £69 17s. 9d. In sowing, 25 lb. seed per acre is drilled in.

Results of Departmental Tests of the Season's Wheats.

The Chemist has lately been conducting a number of analytical tests of the present season's wheat, the results of which will be of interest to millers and others in the flour trade. Samples were obtained from the principal milling firms, and also from the Department's wheat plots at the Wagga Experimental Farm. Generally speaking, the tests demonstrated that the early wheat—that harvested before Christmas—was of excellent quality. The grain was heavy, plump, and well filled; the gluten content was high, and the wheat yielded a good quantity of flour of high strength and good colour. The later wheat, however, which had been harvested after Christmas, was of less satisfactory quality, rain having fallen at an inopportune time. Some of the samples were a good deal pinched or shrunken, yielding less flour, and others were bleached. These samples had suffered in strength, and were not so heavy, being poor in gluten. The bleached samples were especially of very poor quality, and the flour yielded was of rather starchy colour. The difference of the samples was thus in favour of the early wheat-producing districts, such as those in the south-west, the Riverina, &c., while it was the later or cooler districts that were found to have been prejudicially affected by the rain.

Manure Experiments with Wheat at Wagga, 1903.

F. B. GUTHRIE AND R. HELMS.

THE experiments here recorded are in continuation of those carried on at the Experiment Farm, Wagga, for the past three years. The results of the harvest of 1901 are recorded in the *Agricultural Gazette* for June, 1902. The harvest of 1902 was not weighed, as the season had been an extraordinarily dry one, and the results would have had no value, the manures having been practically without effect.

The land reserved for the experiments in 1901 is now fairly uniform, though a few plots had still to be rejected in averaging the results on account of the presence of an old road. The land after preparation for the next season should be almost quite uniform. The method of laying out the plots reduces the effect of their irregularities to a minimum.

The plan adopted is shown in the accompanying diagram.

The seed was sown early in June, 1903, a date which is much later than is desirable in the district, but owing to the abundance of rain and the magnificent season the late sowing did not affect the excellence of the harvest, and the results show in a very striking way the benefits due to suitable manuring, and also the comparative action of the different classes of fertilisers. The plots were one-tenth acre plots, and were harvested separately with the horse-mower, the product from each individual plot being threshed and weighed separately. As each plot was sown in triplicate (as will be seen from the plan) the figures given are in nearly all cases the mean of three plots. The exceptions being such few plots as falling on the line of the old road or for other reasons, were not taken into account. With these few exceptions the triplicate plots gave remarkably uniform results amongst themselves.

The harvesting was done between 10th December and Christmas.

Our best thanks are due to the manager, Mr. G. M. McKeown, for the assistance afforded in the conduct of the experiment, and to Mr. G. Fuller, farm foreman, who personally superintended the harvesting and threshing, and to whom we are indebted for much valuable help and advice. The following records of rainfall at Wagga during the period that the crop was in the ground has been kindly supplied by the Acting Government Astronomer, Mr. H. A. Lenehan, F.R.A.S.

SOUTH.

53	54	55	56	49		61	62	63	64	57
56	49	50	51	52		64	57	58	59	60
51	52	53	54	55		59	60	61	62	63
54	55	56	49	50		62	63	64	57	58
49	50	51	52	53		57	58	59	60	61
37	38	39	40	33		45	46	47	48	41
40	33	34	35	36		48	41	42	43	44
35	36	37	38	39		43	44	45	46	47
38	39	40	33	34		46	47	48	41	42
33	34	35	36	37		41	42	43	44	45
21	22	23	24	17		29	30	31	32	25
24	17	18	19	20		32	25	26	27	28
19	20	21	22	23		27	28	29	30	31
22	23	24	17	18		30	31	32	25	26
17	18	19	20	21		25	26	27	28	29
5	6	7	8	1		13	14	15	16	9
8	1	2	3	4		16	9	10	11	12
3	4	5	6	7		11	12	13	14	15
6	7	8	1	2		14	15	16	9	10
1	2	3	4	5		9	10	11	12	13

NORTH

EAST.

RAINFALL OBSERVATIONS, made at Wagga Wagga, New South Wales, from June 1st, 1903, to February, 1st, 1904.

Date.	June.	July.	August.	September.	October.	November.	December.	January.
1	......	30	3	20	......	......	......	......
2	......	25	......	32	1	32	......	33
3	......	......	5	3	......	5	......	......
4	3	15	......	......	......	......	......	174
5	13	......	......	29	......	......	......	......
6	21	5	......	......	......	......	......	......
7	......	......	......	4	......	......	......	......
8	55	......	......	......	......	......	......	......
9	23	......	......	......	......	......	......	......
10	15	......	......	......	......	......	......	......
11	6	......	23	......	......	14	......	......
12	18	......	......	......	3	......	......	......
13	30	......	......	......	104	......	......	......
14	......	3	......	22	11	......	......	10
15	......	36	......	......	......	......	......	2
16	7	60	......	......	......	......	......	......
17	4	9	20	7	......	......	......	......
18	......	2	2	165	......	......	......	11
19	......	......	......	1	......	......	......	......
20	15	3	......	......	1	......	......	2
21	......	......	2	......	3	......	20	11
22	1	......	3	......	62	......	......	22
23	3	......	......	......	2	......	......	......
24	4	......	......	15	......	......	......	......
25	......	......	......	14	......	1	......	......
26	3	......	......	28	......	......	......	......
27	......	17	......	......	......	......	......	1
28	......	12	......	52	......	......	......	......
29	......	9	......	6	......	......	......	......
30	4	10	......	3	......	39	5	......
31	......	5	......	......	......	......	......	......
Total ...	2·28	2·41	0·58	4·01	1·87	0·91	0·25	2·66
No. of Days...	17	15	7	15	8	5	2	9

The first series of plots are arranged to show the effect of manuring with single fertilisers (containing only one fertilising ingredient), with mixtures of complete manures, and with mixtures in which one or other of the ingredients are omitted. These experiments it is proposed to repeat year after year on the same plots so that they may

remain a standing object lesson as to the action of the different plant-foods. This is the third year in which they have been thus treated. The accompanying table gives the treatment and the yield of grain per acre from these plots :—

To test requirement of Land for different kinds of Plant-food.

I.—On Unlimed Land.

Plot	Manure per acre, 1901, 1902, 1903.	Appearance of plots, Sept. 16th, 1903.	Yield per acre in bushels. 1901.	1903.	Increase over unmanured plots. 1901.	1903.	Money-value of increased yield.	Cost of Manure.	Money-gain or loss per acre due to use of manures.
					b'hs.	b'hs.	s. d.	s. d.	s. d.
1	No manure	Backward and thin ...	17⅔	20⅔	...	...	1 10	...	...
2	60 lb. sulphate of ammonia...	Uneven and backward, hardly better than 1.	17⅓	21⅓	...	⅔	...	7 6	− 5 8
3	200 lb. superphosphate ...	Very good	22⅔	33	5	12⅓	34 0	8 0	+26 0
4	30 lb. sulphate of potash.. ...	Fair on the whole, but uneven.	19⅓	23	1⅔	2⅓	6 6	3 9	+ 2 9
5	60 lb. sulphate of ammonia, 200 lb. superphosphate.	Very good	20⅔	32	3	11⅓	31 3	15 6	+15 9
6	60 lb. sulphate of ammonia, 30 lb. sulphate of potash.	Fair to good	19½	21⅔	1⅚	1	2 9	11 3	− 8 6
7	200 lb. superphosphate, 30 lb. sulphate of potash.	Very good	19⅙	32⅔	1½	12	33 0	11 9	+21 3
8	60 lb. sulphate of ammonia, 200 lb. superphosphate, 30 lb. sulphate of potash.	Very good	20⅓	32⅓	2⅔	11⅔	32 0	19 3	+12 9

II.—On Land previously Limed at the rate of about half a ton per acre.

Plot.	Manure per acre, 1903.	Appearance of plots, Sept. 16th, 1903.	Yield pre acre, 1903.	Increase over unmanured plots, 1903.
			bushels.	bushels.
9	No manure	Uneven and backward	21⅔	....
10	60 lb. sulphate of ammonia	Fair	21¾	....
11	200 lb. superphosphate...	Very good	31	9⅓
12	30 lb. sulphate of potash	Fair, but backward compared with 11.	21⅔	....
13	60 lb. sulphate of ammonia, 200 lb. superphosphate.	Very good	31¾	10$\frac{1}{12}$
14	60 lb. sulphate of ammonia, 30 lb. sulphate of potash.	Backward and thin	22	⅓
15	200 lb. superphosphate, 30 lb. sulphate of potash.	Very good	29	7⅓
16	60 lb. sulphate of ammonia, 200 lb. superphosphate, 30 lb. sulphate of potash.	Very good	31	9⅓

The columns giving the money-gain are calculated on the assumption that the bushel of grain is worth 2s. 9d. to the farmer, which is Mr. McKeown's estimate of its value on the farm, and does not take into account the increased amount of straw and chaff due to the use of manures.

The action of lime on this particular soil appears to be almost nil, and the money gains or losses have not been calculated, as they might prejudice the use of this substance on soils which do require it.

A comparison of these plots shows the value of superphosphate for grain on this class of soil. The unlimed plots, containing superphosphate alone, have actually yielded more than when this fertiliser is mixed with potash and ammonia salts.

In 1901 and 1900, when these plots were previously harvested and weighed, this was even more strikingly shown, and it is instructive to compare the results for the three years during which observations were made. This comparison is made in the following table:—

	1900.	1901.	1903.
	bushels.	bushels.	bushels.
No manure (Plot 1)	$7\frac{2}{3}$	$17\frac{2}{3}$	$20\frac{2}{3}$
Superphosphate only (Plot 3)	$13\frac{1}{3}$	$22\frac{2}{3}$	33
Complete manure (Plot 8)	10	$20\frac{1}{3}$	$32\frac{1}{3}$

That is to say, in 1900 the plots manured with superphosphate alone yielded 17 per cent. more grain than those to which a complete manure had been added; whereas, in 1901, this excess was 10 per cent., and in the present season only 4 per cent. There are two explanations possible of this fact, either that the moister seasons of 1903 and 1901 have rendered the effect of the potash and ammonia salts more striking, or that the land, originally well supplied with these ingredients, is becoming exhausted in this respect, and the addition of superphosphate alone is becoming less beneficial, and will, in the course of a year or two, become insufficient. I am inclined to the latter view; but it will be necessary to await the results of one or two more harvests in these plots before a definite opinion can be expressed. It must be remembered that the land on which these experiments are being carried out was new land in 1901, and has not yet become exhausted, so that the action of superphosphate alone is most marked.

The next series shows the relative yields obtained by using superphosphate alone in different proportions.

Superphosphate used alone in different proportions.

Plot.	Manure per acre.	Appearance of plots, September 16th.	Yield per acre in bushels	Gain per acre over unmanured plots.	Money-value of increased yield.	Cost of manure.	Money-gain per acre due to use of manures.
				bushels.	s. d.	s. d.	s. d.
25	No manure	Backward and thin...	$19\frac{2}{3}$	......	......	......	......
3	200 lb. superphosphate	Very good	33	$13\frac{1}{3}$	36 8	8 0	+28 8
18	150 lb. ,, ...	,, ...	$32\frac{5}{6}$	$13\frac{1}{6}$	36 3	6 0	+30 3
19	100 lb. ,, ...	Good; thin in parts	$29\frac{1}{2}$	$9\frac{5}{6}$	26 9	4 0	+24 9
20	75 lb. ,, ...	Fair to good	$28\frac{1}{2}$	$8\frac{5}{6}$	24 0	3 0	+21 0
21	50 lb. ,, ...	Fair	$28\frac{2}{3}$	9	24 6	2 0	+22 6

Thomas' Phosphate.

At the time of sowing, it was, unfortunately, impossible to obtain Thomas' phosphate in New South Wales, and the manuring with this ingredient was omitted. The plots were, however, harvested and

threshed with the others, and the results are extremely interesting in showing the effects of previous years' manuring, as the following table will show :—

Plot.	Manure applied per acre.			Yield per acre.		Increased yield over unmanured plots.		Money-value of increased yield (1903).	Cost of manure in 1902.	Money-gain per acre due to use of manures in 1902.
	1901.	1902.	1903.	1901.	1903.	1901.	1903.			
				b'hs.	b'hs.	bushels	bushels	s. d.	s. d.	s. d.
25	None	None	None	$18\frac{1}{3}$	$19\frac{2}{3}$	......	......	......	......	......
29	300 lb. Thomas' phosphate.	200 lb. Thomas' phosphate.	,, ...	$23\frac{1}{5}$	$32\frac{5}{6}$	5	$13\frac{1}{6}$	26 3	8 0	+28 3
30	200 lb. ,, ...	150 lb. ,, ...	,, ...	$23\frac{1}{3}$	$30\frac{1}{4}$	5	$10\frac{1}{4}$	29 0	6 0	+23 0
31	100 lb. ,, ...	100 lb. ,, ...	,, ...	$22\frac{2}{3}$	$26\frac{3}{4}$	$4\frac{1}{3}$	$6\frac{1}{2}$	18 0	4 0	+14 0
32	50 lb. ,, ...	50 lb. ,, ...	,, ...	21	$25\frac{1}{2}$	$2\frac{2}{3}$	$5\frac{5}{6}$	16 0	2 0	+14 0

It will be seen that the application of 300 lb. Thomas' phosphate resulted in an increase of 5 bushels in the harvest of that year, 1901, and that this yield was more than doubled in the present harvest, although no manure whatever was added this year, and the crops had to utilise the balance of the 200 lb. Thomas' phosphate applied in 1902. It will be remembered that the crops in 1902 were so poor, owing to the drought, that the plots were not weighed in that year. On this account it is quite possible that the fertiliser was not utilised to any extent, and that the amount then added remained practically unchanged until the moister weather and heavier crops of this season rendered it active.

The effects of Thomas' phosphate has been quite equal, both in this year and in 1901, to those obtained from the use of superphosphate.

Plot 38 had received, in previous years, a mixture of 200 lb. Thomas' phosphate, and 100 lb. superphosphate, with a light spring top-dressing of 35 lb. sulphate of ammonia. This year both the Thomas' phosphate and the top-dressing were omitted, and only the superphosphate added. The average yield of the three plots so tested was $32\frac{2}{3}$ bushels, or about the same as plot 29, which received 200 lb. Thomas' phosphate in 1902 and no manure at all this year.

Plots 39 and 41 were interesting. Their history is as follows :—

Plot.	Manure per acre.		Yield.		Yield over unmanured plot.	
	1901 and 1902.	1903.	1901.	1903.	1901.	1903.
			bushels	bushels	bushels	bushels
39	300 lb. Thomas' phosphate, 30 lb. sulphate potash, 35 lb. sulphate of ammonia.	30 lb. sulphate of potash only.	20	$34\frac{1}{3}$	$1\frac{2}{3}$	$14\frac{2}{3}$
41	300 lb. Thomas' phosphate, 90 lb. nitrate of soda.	90 lb. nitrate of soda only..	$19\frac{1}{3}$	$30\frac{3}{4}$	1	$11\frac{1}{12}$
25	No manure	No manure	$18\frac{1}{3}$	$19\frac{2}{3}$	......	......

No. 39 is the largest average yield obtained, and one of the three plots gave $36\frac{5}{6}$ bushels per acre, which is the largest individual

yield for one plot. This would appear to indicate the most economical way of applying potash salts. Further information will be obtainable on this point during the coming season.

Plots 33 to 37 and plot 42 call for no special remark. They were originally devised to show the effect of the use of Thomas' phosphate with the seed, followed by top-dressings of different kinds. Owing to the impossibility of obtaining Thomas' phosphate at the time of sowing, the plots did not receive any of this fertiliser in 1903, and the top-dressing was also dispensed with as the growth was so luxuriant that it was considered unnecessary and likely to result in loss of grain through the overloading of the plants.

Consequently these plots are in the same position as Nos. 29-32, in that they received full manuring in 1901 and 1902, and none at all in 1903. They are tabulated in the accompanying list :—

	Manure per acre.			Yield per acre.		Increased Yield over Unmanured Plots.	
	1901.	1902.	1903.	1901.	1903.	1901.	1903.
				bushels	bushels	bushels	bushels
33	300 lb. Thomas' phosphate. *Top-dressing*, 50 lb. superphosphate	Same manuring; 200 lb. Thomas' phosphate instead of 300 lb.	None...	22⅔	33	4⅓	13⅓
34	300 lb. Thomas' phosphate. *Top-dressing*, 50 lb. superphosphate, 35 lb. sulphate of ammonia.		,, ...	22½	33⅔	4⅙	14
35	300 lb. Thomas' phosphate. *Top-dressing*, 50 lb. superphosphate, 35 lb. sulphate of ammonia, 30 lb. sulphate of potash.		,, ...	21⅔	31⅔	3⅓	12
36	300 lb. Thomas' phosphate. *Top-dressing*, 50 lb. superphosphate, 30 lb. dried blood		,, ...	22	33	3⅔	13⅓
37	300 lb. Thomas' phosphate *Top-dressing*, 30 lb. dried blood.		,, ...	23⅓	32⅔	5	13

The plots manured with bone-dust were also left unmanured this year, in order to test the value of this manure in its second year. The results are somewhat irregular, but are tabulated here for what they are worth.

Bone-dust.

Plot.	Manure per acre.		Yield per acre.		Increased Yield over Unmanured Plots.	
	1901 and 1902.	1903.	1901.	1903.	1901.	1903.
			bushels	bushels	bushels	bushels
25	None	None	18⅓	19⅔	......	......
43	400 lb. bone-dust	,, ...	22⅔	33	4⅓	13⅓
44	300 lb. ,, ...	,, ...	22½	29⅙	4⅙	9½
45	200 lb. ,, ...	,, ...	20	31½	1⅔	11⅚
46	100 lb. ,, ...	,, ...	19⅙	29	0⅚	9⅓

It will be seen that the application of bone-dust in 1902 has resulted in a considerably increased crop in the following year without any further manuring.

Pacific Island Rock Phosphate.

The Pacific Island rock phosphate used in previous years was not obtainable on this occasion, and the blocks were sown (as was the case with the Thomas' phosphate) without the addition of manure, so that the figures for 1903 show the result of the previous years' manuring.

Plot.	Manure applied.		Yield per acre.		Increased Yield over Unmanured Plots.	
	1901 and 1902.	1903.	1901.	1903.	1901.	1903.
			bushels	bushels	bushels	bushels
25	None	None	18⅓	19⅔	......	......
26	140 lb. Pacific Island Phosphate ...	„	20	24	1⅔	4⅓
27	70 lb. „ „ ...	„	19⅓	21½	1	1⅚
28	35 lb. „ „ ...	„	18⅓	20⅙	......	½
49	140 lb. „ „ *Top-dressing*, 100 lb. dried blood.	„	19⅙	25½	⅚	5⅚
50	140 lb. Pacific Island Phosphate. *Top-dressing*, 60 lb. sulphate of ammonia.	„	18⅔	26⅔	⅓	7
51	140 lb. Pacific Island Phosphate. *Top-dressing*, 90 lb. nitrate of soda.	„	1[illegible]½	26⅓	......	6⅔
52	100 lb. Pacific Island Phosphate. *Top-dressing*, 50 lb. superphosphate, 60 lb. sulphate of ammonia, 30 lb. sulphate of potash.	„	19⅙	31	⅚	11⅓
53	100 lb. Pacific Island Phosphate, 50 lb. superphosphate. *Top-dressing*, 60 lb. sulphate of ammonia, 30 lb. sulphate of potash.	„	19½	29⅔	1⅙	10
54	210 lb. Pacific Island Phosphate. *Top-dressing*, 60 lb. sulphate of ammonia, 30 lb. sulphate of potash.	„	18⅓	29	......	9⅓

It will be seen from this table that the action of this rock phosphate is almost nil the first year, and when used alone the increase in the second year is very small indeed compared with that of the more soluble phosphates, such as superphosphate and Thomas' phosphate, the only plots showing any appreciable increase being those which received the addition of more soluble fertilisers as top-dressing.

Florida Rock Phosphate.

The action of this fertiliser is shown in the following table:—

Plot.	Manure per acre.	Yield per acre.		Increased Yield per acre over Unmanured Plots.	
	1901, 1902, and 1903.	1901.	1903.	1901.	1903.
		bushels.	bushels.	bushels.	bushels.
25	None	18⅓	19⅔	......	......
22	140 lb. Florida Rock Phosphate	20	30⅓	1⅔	10⅔
23	70 lb. „ „	18⅓	27⅚	......	8⅙
24	210 lb. „ „	21⅙	30½	2⅚	10⅚

The effects of the Florida Rock are more apparent in the second year than is the case with the Pacific Island, but the results fall far short of those obtained by the use of the same amounts of phosphoric acid in the more soluble forms.

Complete Manure in different proportions.

Plots 57, 58, and 59 are to be compared with Plot 8. They contain the same ingredients constituting a complete quick-acting manure, but in different proportions.

Plot.	Manure per acre.	Yield per acre.		Increased Yield per acre over Unmanured Plots.		Money-value of increased yield.	Cost of manure.	Money-gain per acre due to use of manure.
	1901, 1902, and 1903.	1901.	1903.	1901.	1903.			
		b'hs.	b'hs.	b'hs.	b'hs.	s. d.	s. d.	s. d.
1	No manure	17⅔	20⅔	...	...	...	...	...
8	60 lb. sulphate of ammonia, 200 lb. superphosphate, 30 lb. sulphate of potash.	20⅓	32⅓	2⅔	11⅔	32 0	19 3	+19 9
57	30 lb. sulphate of ammonia, 100 lb. superphosphate, 15 lb. sulphate of potash.	22⅙	32½	4½	11⅚	32 6	9 9	+22 9
58	30 lb. sulphate of ammonia, 200 lb. superphosphate, 15 lb. sulphate of potash.	23⅚	32⅓	6⅙	11⅔	31 6	13 9	+17 9
59	120 lb. sulphate of ammonia, 100 lb. superphosphate, 60 lb. sulphate of potash.	20⅙	26	2½	5⅓	14 8	26 6	—11 10

In both years an increased yield has resulted from the use of half the quantities employed in Plot No. 8 (*see* Plot 57). The greater comparative value of superphosphate in 1901 to its value in the present season is shown in Plot 58, and Plot 59 shows in a very striking manner the inefficiency of larger proportions of potash and ammonia salts.

Plots 60 and 61 represent the action of a complete manure compounded of bone-dust and potash salts, 61 having some superphosphate in addition. These plots have received the same manuring for the three years, and the results are as follows:—

Bone-dust and Potash.

Plot.	Manuring per Acre.	Yield per Acre.		Increased Yield over Unmanured Plots.	
	1901, 1902, and 1903.	1901.	1903.	1901.	1903.
		bushels.	bushels.	bushels.	bushels.
25	None	18⅓	19⅔	......	......
60	350 lb. bone-dust, 30 lb. sulphate of potash ...	21⅔	32⅔	3⅓	13
61	250 lb. bone-dust, 100 superphosphate, 30 lb. sulphate of potash.	23⅔	31	5⅓	11⅓

Application of the whole of the Manure as Top-dressing.

In blocks 62, 63, 64 no manure was sown with the seed, the complete manures being added in the form of a top-dressing in the spring in 1901. In this year (1901) the effect of this application was hardly noticeable, as none of the top-dressings had been effective, owing to the dry weather following their application. In 1902 the season was so dry that the idea of weighing the harvest was abandoned, and these plots were not top dressed. In 1903 these plots looked so well, owing to the delayed action of the manures added in 1901, that it was decided to omit the top-dressing. The gain

this year is, therefore, due entirely to the application of manure made in the spring of 1901 which is only now producing its effect in a favourable season.

Plot.	Manuring per acre.			Yield per acre.		Increased Yield over Unmanured Plots.	
	1901.	1902.	1903.	1901.	1903.	1901.	1903.
				bushels	bushels	bushels	bushels
25	None	None ...	None ...	18⅓	19⅔	......	......
62	40 lb. sulphate of ammonia, 200 lb. superphosphate, 25 lb. sulphate of potash.	" ...	" ...	18⅓	29	......	9⅓
63	60 lb. sulphate of ammonia, 300 lb. superphosphate, 30 lb. sulphate of potash.	" ...	" ...	18⅔	30⅓	⅓	10⅔
64	75 lb. Thomas' phosphate, 40 lb. sulphate of ammonia, 200 lb. superphosphate, 25 lb. sulphate of potash.	" ...	" ...	19	29⅙	⅔	9½

Owing to the fact that the harvest of 1902 was not weighed, and that the manures added in that year were only partially used up, and in many cases were probably not used at all, there is some difficulty in calculating the money gain or loss in cases where the manuring has been different in different years. In these cases the calculations of gain and loss have been omitted, as definite statements to this effect would be misleading. The manures added and the yields obtained in the different years are, however, published, and the gain and loss for each individual year can be readily calculated.

Areas of Farms and Orchards in California.

There are 72,542 farms in California, with an average size of 397·4 acres, says an article compiled for the California Promotion Committee. Of these farms, 1,492 are under 3 acres in extent; 5,342 are between 3 and 10 acres; 8,236 are between 10 and 20 acres. The larger farms are as follows:—13,110 are between 20 and 50 acres; there are 8,067 between 50 and 100 acres, and there are 13,196 farms between 100 and 175 acres. There are 4,635 farms ranging from 175 to 260 acres; 8,370 between 200 and 500 acres; 5,329 between 500 and 1,000 acres, and 4,753 farms more than 1,000 acres in extent.

Of the 72,542 farms in California, the following table shows what some of them produce, also giving their size:—

	Total Farms.	Average No. Acres.
Hay and grain	19,048	533
Vegetables	3,045	89
Fruits...	18,537	96
Live stock	15,418	812
Dairy produce	8,686	274·8
Tobacco	1	640
Sugar (beet)	386	179
Flower plants	208	8·3
Nursery products	141	47·4
Miscellaneous	7,072	231·5

Hawkesbury Agricultural College and Experimental Farm.

Experimental Wheats at the H.A. College. Season, 1903.

GEO. L. SUTTON,
Experimentalist.

The varieties tried on the experimental plots are grown rather with the object of determining their rust-resisting qualities than of comparing their relative productiveness. The present season was admirably suited for this purpose. As the wheats approached maturity the atmospheric conditions were such as were eminently favourable for the development of rust, with the result that any variety at all susceptible was attacked. Several varieties actually perished as a result of the attack of the pest. The past season has been considered the worst for rust we have had for many years. Those varieties which resisted the attacks of the pest sufficiently to produce grain, must, therefore, be considered rust-resistant to a very high degree; and many of those varieties which, this season were useless for any practical purpose, would perhaps in a season less moist produce hay or grain of good quality.

As a rust-resister, pride of place must be given to the new variety, Nutcut, which was entirely free from streaky rust. It matured rather late, consequently the trial was the more severe, yet no sign of rust was found on any part of the straw. The variety, Bobs, had hitherto been regarded as the best rust-resister we had, but as this variety neared maturity some specks of rust were found on the straw. This slight attack did not, to any appreciable extent, affect the plumpness of the grain produced.

It is worthy of notice in connection with Bobs, that a 3-acre block of this variety grown for hay in an adjoining paddock on the farm was considered by many old farmers as the finest block of hay-wheat ever grown in this district. Another 3-acre block sown a little earlier than the experimental varieties was allowed to mature. It was entirely free from rust and produced a fine sample of grain. This block was estimated, by Mr. T. C. Worboys, to yield 30 bushels per acre.

The contrast between the rust-liable and rust-resistant varieties was very strongly marked. Many visitors who saw the wheats whilst maturing, considered it nothing short of wonderful that such a difference in the ability of the varieties to resist rust should exist. At one

time Nutcut was quite clean, Bobs almost clean and free from rust, whilst Steinlee and Steinwedel had perished from its attacks. Farmers' Friend, Purple Straw, and White Lammas were not dead, but were quite worthless even for straw.

Wheats from France.

Four varieties of wheats were received per the Seed Department from France. They were—

(1) Epautre ordinaire blanc sans barbes.
(2) Engrain commun.
(3) Ammidonnier noir.
(4) Ammidonnier blanc.

None of these varieties have any special quality to recommend them as suitable for our conditions. Nos. 1 and 2 never ran into straw, but are soft and creeping in their habit and appear to be more suitable here for grazing than for any other purpose.

Nos. (3) and (4) are bearded. No. 3 was so rusty as to be useless. No. 4 was quite clean, but the beards mitigate against its usefulness. In its early stages, before the beards became harsh, it could be used for greenstuff. The grain is good, but cannot be separated from the chaff without an enormous amount of labour. The straw is strong and stiff, suitable for thatching.

Wheats from South Australia.

Samples of the wheats obtained from South Australia for seed distribution amongst the farmers in the drought-stricken districts were forwarded here for trial by Mr. H. V. Jackson, Secretary to the Board of Exports. The seed, on the whole, was a fine sample. One or two varieties were not quite clean, but the others were very good. One variety, "Excelsior," was particularly fine. They were named as follows:—

Gluya's Early.	Pioneer Purple.
King's Early.	Marshall's No. 3.
Excelsior.	Dart's Imperial.
Purple Straw.	Phillis' Marvel.
California Purple.	Steinwedel.

Gluya's Early was the earliest maturing wheat grown here, and, on account of its earliness, escaped the effects of the rust, and produced a very fine sample of grain. Phillis' Marvel and Marshall's No. 3 would have made a fair sample of hay, and Marshall's No. 3 also

produces a fair sample of grain. The remaining varieties were so rust-liable as to be almost worthless.

Further details regarding the varieties will be found under their respective names in the tabulated list.

Wheats from South Africa.

Fourteen samples of wheat were sent per the Board of Exports from South Africa by Mr. Valder, as typical samples found on the market in that country. They comprised locally-grown and imported samples, the latter being from Australia, New Zealand, and America. Several of the samples were mixed. Mr. Musson, who examined them, found weevil, grain moth, weed seeds, oat, and foreign wheat amongst them. They were classified as follows:—

Cape Colony White Wheats.

1. Baard.
2. Klem or Woll.
3. Du Toits.

Cape Colony Red Wheats.

4. Medeah.
5. Red Baard.

Imported White Wheats.

6. American White (Blue Stem).
7. Australian White.
8. New Zealand White Tuscan.
9. New Zealand Hunter's White.
10. Pearl.

Imported Red Wheats.

11. Manitoba.
12. Barletta
13. Red Spring.
14. Barletta No. 2.

Not having a complete set of nomenclature plots at the College, we were unable to determine whether the varieties were correctly named, or synonymous with any local varieties.

It was, however, found that No. 4, called Medeah in South Africa, was not Medeah, though it resembles the latter in habit of growth and in the character of its grain. One noticeable point of difference is that No. 4 has woolly chaff whilst Medeah has smooth.

The produce from No. 11, Manitoba, would have made a fair sample of hay, and No. 4, like Medeah, produces a very fair quantity and quality of grain. The remainder were so rusty as to be useless for any purpose.

Further details of the varieties will be found under their respective names in the tabulated list.

Wheat from Western Australia.

This was a variety called "Lots," sent here by the Under Secretary of Agriculture for that State, as being one of the best, if not the best, variety grown in Western Australia. The sample received was exceptionally fine, somewhat resembling Steinwedel in appearance. However, during its growth it was found not to be of that variety. It proved very rust-liable and matured hardly any grain. The small quantity of grain obtained was small and pinched, quite a contrast to the sample sown.

In the following table the varieties are arranged in an order fairly representative of their rust-resistance. They were planted during the third week in May. Two drills of each variety were sown. The drills were 1 chain long and 1½ feet apart.

EXPERIMENTAL Wheats at the Hawkesbury Agricultural College, season 1903, arranged in order of their rust-resistance.

	Seed obtained from.	Flowering.	Harvested.	Height.	Remarks.
Varieties suitable for Hay and Grain.					
		1903.	1903.	ft. in.	
Nutcut	Wagga ...	5 Nov. ...	11 Dec. ...	4 4	Free from rust; a fine hay wheat, produced a fine sample of grain.
Bobs	Bathurst ...	31 ,, ...	1 ,, ...	4 5	Almost free from rust at maturity; a fine hay wheat, and produced a good grain short and plump.
Sinew	H. A. C. ...	12 ,, ...	15 ,, ...	4 10	Good colour for hay, straw fairly fine.
Biceps	H. A. C. ...	10 ,, ...	1 ,, ...	5 3	Good colour for hay, straw rather coarse but strong.
Marshall's No. 3 ...	South Australia.	19 Oct. ...	21 Nov. ...	4 6	Good for hay, but weak in straw—grain fairly good.
Varieties suitable for Grain—Macaroni Varieties.					
F. R., from Samara..	H. A. C. ...	5 Nov. ...	15 Dec. ...	6 0	Vigorous growers, with stiff, strong beards; good yielders; very slight trace of rust.
Cretan...	H. A. C. ...	9 Oct. ...	11 ,, ...	6 0	
Farrer's Durum ...	H. A. C. ...	18 ,, ...	14 ,, ...	5 10	
Medeah	H. A. C. ...	29 Sept. ...	30 ,, ...	6 1	
Belotourka	H. A. C. ...	18 Oct. ...	15 ,, ...	5 10	
Like Medeah ...	South Africa.	19 ,, ...	3 ,, ...	6 6	
Kubanka	Lambrigg ...	5 Nov. ...	....	6 1	Rust on straw; suffered from blighting; stiff beards.
Varieties suitable for Grain—Milling Varieties.					
Eyes Right	H. A. C. ...	19 Oct. ...	19 Nov. ...	4 0	Rusty, but ears fill well; produces a good sample grain.
Gluya's Early ...	South Australia.	29 Sept. ...	12 ,, ...	4 9	Very early; fine straw; escaped rust on account of its earliness; the earliest variety grown this season.
Varieties suitable for Hay.					
Yandilla	H. A. C. ...	2 Oct. ..	11 Oct. ...	3 1	Very early; suitable for Hay, but developed rust as it matured.
Nonpareil	Wagga ...	5 Nov. ...	12 Dec. ...	4 5	A late variety; good colour for Hay.
Blount's Lambrigg...	H. A. C. ...	12 ,, ...	18 ,, ...	3 11	A late variety; becomes rusty as it matures.
Phillis Marvel ...	South Australia.	5 ,, ...	21 Nov. ...	4 7	Good colour, and soft straw; becomes rusty as it matures.
Manitoba	South Africa.	5 ,, ...	18 Dec. ...	4 4	A fair hay wheat; straw coarse and weak; sample mixed with bearded variety.

	Seed obtained from.	Flowering.	Harvested.	Height.	Remarks.
		Unsuitable for Hay or Grain.			
		1903.	1903.	ft. in.	
Cumberland	Wagga ...	19 Oct. ...	5 Dec. ...	4 6	
Federation	Seed Dept..	19 „ ...	10 Nov. ...	3 6	
Allora Spring ..	Sydney ...	19 „ ...	....	4 0	
Lambrigg White Lammas.	Wagga ...	5 Nov. ...	12 Dec. ...	4 3	Very rusty; any grain formed was pinched very badly, and not worth harvesting.
Jonathan	H. A. C. ...	26 Oct. ...	10 Nov. ...	4 7	
Jade	Wagga ...	19 „ ...	....	3 11	
Zealand	Wagga ...	5 Nov. ...	12 Dec. ...	4 0	
New Zealand White Tuscan.	South Africa.	5 „ ...	18 „ ...	4 7	Resembles Lambrigg White Lammas: very rusty.
Pearl	South Africa.	5 „ ...	23 „ ...	3 6	Resembles New Zealand White Tuscan and Lambrigg White Lammas; very rusty.
New Zealand Hunter's White.	South Africa.	5 „ ...	23 Nov. ...	3 6	Very leafy; leaf discoloured; very rusty.
American White (Blue stem.)	South Africa.	5 „ ...	....	4 4	Soft weak straw; very rusty.
Australian White ...	South Africa.	5 „ ...	27 Nov. ...	4 8	Rust on straw, sheath and ears.
Excelsior	South Australia.	7 Oct. ...	27 „ ...	4 0	Early; rust on straw sheath and ears.
Dart's Imperial ...	South Australia.	19 „ ..	....	4 3	.... Rust on straw, sheath, and ears.
Hudson's Early Purple Straw.	South Australia.	5 Nov. ...	5 Dec. .	4 3	....
Purple Straw .	South Australia	19 Oct. ..	5 „ ..	4 8	....
Farmers' Friend ..	South Australia.	26 „ ..	5 „ ..	4 3	....
Barletta	South Africa.	19 „ ...	18 „ ..	4 8	Bearded sample mixed with barley.
Barletta No. 2 ...	South Africa.	5 Nov. ...	18 „ ..	4 8	Bearded.
Red Spring	South Africa.	5 „ ...	18 „ ..	4 6	Bearded. Two distinct varieties in this sample.
Baard	South Africa.	19 Oct. ..	27 Nov. ..	4 6	Bearded.
Red Baard	South Africa.	19 „ ...	27 „ ..	4 11	Bearded.
Klein or Wo'l ..	South Africa.	5 Nov. ...	18 Dec. ..	4 1	Bearded.
Du Toits	South Africa.	19 Oct. ...	21 Nov. ...	4 2	Several varieties grew from sample of seed.
Poland...	Seed Depart.	5 Nov. ...	1 Dec. ..	5 2	Bearded.
Algerian	Bathurst ...	31 Oct. ...	12 „	6 0	Bearded: a late variety, suitable for greenstuff if cut early.
Galland's Hybrid ...	H. A. C. ..	31 „ ...	18 „ ..	5 6	Bearded; a late variety, suitable for greenstuff if cut early.
King's Early	South Australia.	29 Sept. ...	21 Nov. ..	4 4	Bearded.
Lot's Wheat	West Australia.	19 Oct. ...	21 „ ..	4 3	Early.
American White ..	South Africa.	5 Nov. ...	....	4 4	Soft weak straw; did not mature any grain.
Tardents' Blue ...	Wagga ...	21 „ ...	....	4 0	Did not mature grain; laid with rain; making second growth.
Australian Talavera	Wagga ...	5 „ ...	....	4 3	Did not mature grain; laid with rain; making second growth.
Pioneer Purple ...	South Australia.	19 Oct. ...	....	4 7	
Steinwedel	South Australia.	10 „ ...	....	4 8	Killed by rust.
California Purple ...	South Australia.	19 „ ...	21 Nov. ..	4 10	
Steinlee	Wagga ...	19 „ ...	....	4 0	

Trials of Oats.

In the report of trials of varieties of oats in February issue there is reference to a new oat "White Ligoun." The correct name of this oat is "White Ligomo." The description to the illustration should also be read "White Ligomo."

HAWKESBURY DISTRICT FARM NOTES.

H. W. POTTS.

FEBRUARY was a dry month in this district, and the conditions for cultivation were rendered unfavourable. This month, however, it is imperative that the land should be prepared for the sowing of cereals and fodder crops, such as wheat, oats, and barley, with rye on the low-grade soils.

Where the crops are intended for winter green feeding it will be advantageous to combine with them vetches or field peas. The addition of these legumes tends to improve the relishable nature of the fodder for dairy cattle, adds weight to the crop, enhances its food value in the formation of flesh and milk; and being nitrogen gatherers they act as soil renovators.

The Macaroni wheats, if sown early, ought to provide two crops—one for midwinter, and given a good season another cut in November. Blount's Lambrigg has gained an excellent reputation for green fodder.

Barley, when sown on a light, warm, well-drained soil and the growth stimulated with occasional showers, will provide good crops along the coastal areas. The skinless barley has always provided a heavy yield, it is very early and may be cut the second time in the season. Cape barley is also a good cropper and more so when sown with an equal quantity of peas or vetches.

Algerian oats are found best in this district for several reasons. Last season's tests demonstrated afresh their rust-resistant qualities, whilst the White Tartarian maintains its reputation in producing the heaviest crops of green fodder, yet the rusty state of last season's crop was very evident.

There are many patches of poor land on which the only crop worth sowing is rye. This crop is not much affected in its growth by drought.

Lucerne (*Alfalfa*) provides unquestionably the most profitable of all fodders. The quality and richness of it as green or dry fodder, and its ready and prolonged growth on almost any class of soil, even if dry, is bringing this plant into greater use. It is relished by all classes of stock. It thrives best in marly calcareous or limy soil with a porous subsoil. The latter in every instance is most important, seeing in two years the plant derives its chief nourishment from it.

Lucerne naturally grows best in deep soils of a loamy nature—*i.e.*, sandy gravels with a fair percentage of clay throughout. A moist deep subsoil provides the most permanent conditions for continued growth. The chief aim in preparing the land is to secure a well-cultivated, clean, fine seed-bed. Land well manured and drained, clean and following a fallow favours an early vigorous growth. Farmyard manure invariably introduces weeds, but this is met by substituting 3 to 4 cwt. of superphosphate per acre, mixed with 1 cwt. sulphate of potash.*

* For autumn-sown lucerne, bone-dust—2 to 2½ cwt. per acre—well harrowed in before sowing, will be found to be effective and durable.

A matter of vital importance is good seed, free from dodder. Buy only from reputable sources, get a guarantee of purity. A sample may be sent to this College for test. The quantity may range from 12 to 20 lb. per acre, as determined by soil and other conditions. It may be sown in drills or broadcast. As a rule no cultivation is required after sowing.

Cowpeas.—We have ample proof once more this season of the food value of cowpeas and its succulent character in the height of summer heat. The crop is drought-resistant, and essentially a green summer fodder for sheep and pigs. Its value from a manurial point of view must also be considered. It will grow on poor soils, and its succulent foliage is available at a period when such foods are extremely scarce. We must not omit also to recognise its value as a green manure. As soon as the first bloom appears it may be fed. In some instances a second light crop will follow.

Horse beans, black vetches or tares, crimson clover, and peas all can be sown this month.

Swedes.—The ground most suitable for swedes should be deep loam soils, fairly moist, and sufficient sand and clay present to keep them in a friable state.

Rape.—Out of the several varieties offered, Dwarf Essex may be selected as the best. It furnishes a rich, succulent food for horses, cattle, sheep, pigs, and poultry. It gives several successive cuttings. Its feeding value has been estimated to be greater than that of clover per acre. It produces fat and milk in large quantities. In feeding it to dairy cattle, however, care must be observed to feed it only after each milking, in order to prevent it tainting the milk. Rape is a sturdy and vigorous plant, and is noted for its power to resist the extremes of heat and cold. It has been grown on our flats in all seasons, and given yields ranging from 15 to 30 tons per acre. The following conclusions were arrived at by Mr. Sutton last season, which may be recalled with advantage at this stage:—

The results obtained seem to indicate that in a moist season—

I. A broadcasted crop makes better and more rapid growth than a drilled one.

II. The crop increases in weight until it has reached full maturity.

III. To obtain largest returns, two cuttings should be made. The first of these cuttings should not be made very early or very late, but at some period about midway between planting and flowering—*i.e.*, about twelve weeks from planting.

IV. Drilling gives better results than broadcasting only when the first cutting is made at about the time indicated as the most suitable.

V. When the crop is drilled, that in drills which are 2 feet apart produces the largest weight per acre.

TABLE showing the differences in the cost of production per acre, when the rape is planted according to the various methods in the experiment.

	Broadcast.			Drilled 3 feet apart.			Drilled 2½ feet apart.			Drilled 2 feet apart.			Drilled 1½ feet apart.		
	£	s.	d.	£	s.	d.	£	s.	d.	£	s.	d.	£	s.	d.
Ploughing, rolling, and harrowing.	1	0	0	1	0	0	1	0	0	1	0	0	1	0	0
Seed, at 3d. per lb.	0	1	6	0	0	9	0	0	11	0	1	1½	0	1	6
Fertiliser...	1	2	0	1	2	0	1	2	0	1	2	0	1	2	0
Planting	0	1	0	0	2	0	0	2	6	0	3	0	0	4	0
Cultivating (twice)	....			0	4	0	0	5	0	0	6	0	0	8	0
Total ... ... £	2	4	6	2	8	9	2	10	5	2	12	1½	2	15	6

The crop is especially suitable for cleaning land. The most effective manure is farm-yard, but in its absence commercial fertilisers are useful, such as the superphosphates. Rape is very fond of nitrogenous manures, and they render great service when applied on the surface during moist weather. Rape will flourish in deep moist loams where there is a good percentage of sand, but it is surprising the classes of soil it will grow on, provided they are in good mechanical condition. A fine, firm, moist, clean seed-bed should be prepared. A good growth is assured in from eight to twelve weeks. Many animals at first fail to relish this class of food, but if persevered with they soon acquire the taste for it, and eat it ravenously. Fifteen sheep to the acre have been fed and made fit for market in sixty days.

Turnips, swedes, and kohl-rabi, mustard, and kale should be sown this month, and as early in the month as it is possible. These are all valuable fodders for stock, and provide palatable and nutritious changes.

Maize.—Unfortunately our experience of last year, when dry parching weather, accompanied by hot westerly winds, prevailed, has been repeated this season, with equally disastrous results. Our corn crop is seriously damaged in many paddocks and ripening checked. All early-planted varieties will be ready to pull this month.

Sorghum.—The crops this season are not so far forward as last, owing to the rainfall and other causes preventing them being sown. The crops intended for early winter feed and ensilage require continuous shallow cultivation.

Farm Notes.

BATHURST.—March.

R. W. PEACOCK.

Wheat.—Owing to the favourable season no difficulty should be experienced in ploughing, and as much land as possible should be prepared for the reception of the wheat crops. Early sowing invariably ensures satisfactory crops. It also ensures good healthy root development, and such prevents the land getting out of condition so readily by subsequent winter rains. Owing to the ground being warmer the percentage of germination is often higher and more satisfactory, other things being equal. Less seed is required when sown early. The crop also gets ahead of the weeds, which is of considerable importance on weedy land. Towards the end of the month many of the long-season wheats, such as the Lammas, Tuscans, &c., may be sown, and if the season should be favourable these would produce a large quantity of green food during the winter to be grazed off rationally by stock. Many good yields of grain have been obtained from wheats so treated. The early maturing wheats should not be sown until April, for if sown earlier there is a probability of their becoming frosted during the spring. A sowing of some early maturing variety could be made, for green winter fodder, early in the month.

Barleys.—These should be sown largely early in the month for green winter fodder. The skinless and Cape varieties are the best for this district. They require a soil in good heart and with a fair quantity of available plant food near the surface.

Rye should be sown early in the month for green fodder. It possesses the advantages of producing fair yields from poorer soils and of withstanding greater degrees of cold than the other cereals. It is valuable for poor soils.

Tares and Field Peas.—These can be sown for fodder or green manuring during the month. When sown in conjunction with the foregoing cereals, they add materially to the quality of the fodder. The Black Tare and the Grey Field Pea are two of the best for these purposes.

Rape should be sown largely during the month. It requires well prepared land, is a rapid grower of excellent fodder value, especially for ewes and lambs. It is a moderately deep rooter, and withstands a fair amount of dry weather, and is valuable in a rotation. The Dwarf Essex variety is the best.

Root Crops.—Turnips, Swedes, carrots, and parsnips should be sown. They require deep and thorough cultivation and produce excellent food for all classes of stock, possessing the advantage of being easily stored for the late winter months.

Lucerne.—This plant has been deservedly termed the "King of Fodders," it being one of the most nutritious and prolific of fodder crops. It should be sown towards the end of the month, if the weather is favourable, upon deeply-worked well prepared soil. As it occupies

the land for many years, good thorough cultivation is well repaid by the better stand and more substantial yields than are obtained by more slipshod methods. It is not wise to sow it with a shelter crop, it doing much better alone, and should be sown early in order to establish itself before the dry weather of the ensuing summer. It thrives best upon rich alluvial soils unbroken by any stratum of coarse sand or gravel. Upon the lighter soils it produces a fair amount of fodder, and will last for several years. It is valuable in a rotation.

Grasses and Clovers.—Many perennial grasses and clovers should be sown about the end of the month upon well prepared land. When sown during the autumn they establish themselves, and can the better withstand the dry summers, which are the rule in this district.

The growing crops will require cultivating and keeping free from weeds. Some of the early maize will be ripe enough to harvest this month, and the stalks should be cut and stood on either side of a fence or rails arranged for the purpose. They retain their nutriment longer if so treated; and if shredded before being fed, form an acceptable bulky fodder for the dry stock during winter.

RIVERINA NOTES.—March.

G. M. McKEOWN.

As April and May are the best months for sowing for grain production, the work of preparing land should be pushed forward as rapidly as possible. An invaluable implement for early planting will be found in the rotary disc plough, with which stubbles may be broken up far earlier and at much less cost than is possible in land such as ours with mould-board ploughs. Land which has been fallowed should be worked with scarifier, harrow, or spading-harrow, to assist in retaining as much moisture as possible, the rainfall during the last five months having been light. Wheat for hay should be sown in March or early in April, the best varieties being Berthoud or Zealand White Essex and Australian Talavera. White Lammas and Marshall's No. 3 have also given excellent results as hay wheats. Seed should be sown at the rate of about 45 lb. per acre, and a first-class fertiliser will be found in No. 3 superphosphate. During last season we used 70 lb. of this manure per acre, costing 4s. 6d., drilled with the seed, the crops resulting ranging from 52 cwt. to 88 cwt. per acre, according to the variety of wheat and the land selected for sowing. The results of many trials show that there is a great gain in using seed of the best quality, therefore, the plumpest grain only should be used. The use of small quantities of manure drilled in with the seed has again been proved to be most successful; in one case (the only comparative block yet threshed) the increased yield due to the use of manure, costing 2s. 9d. per acre, having been upwards of 13 bushels per acre. No. 1 superphosphate and Japanese superphosphate used at the rate of 60 lb. per acre have given excellent results. One of the many advantages gained by using manures is that the crop ripens about a fortnight earlier than that which has not been fertilised. For smut

or bunt a 2 per cent. solution of Sulphate of Copper is used on all our farm crops with satisfactory results, but the greatest care should be exercised in purchasing to see that only the very best quality of bluestone is obtained. Crushed or bleached material should be rejected.

Rape—Should be sown during this month in finely prepared land, the surface of which has been made as even as possible. If broadcast the seed may be covered by means of a lever harrow. Dwarf Essex is the best variety, and if sown broadcast 3 lb. of seed per acre will be sufficient; a lb. less being required with the drill.

Oats—Should be sown in March. The best varieties are Algerian, Dun, and Rustproof, all of which are somewhat similar in type. For dry districts a bushel of seed to the acre will be ample for hay production. Manure with 60 lb. of No. 1 or No. 3 superphosphate per acre.

Barley.—The best soil for the production of malting barley is a light, free loam, possessing good natural drainage. The soil should be prepared without delay, to admit of sowing in April or May, the latter being the best month for grain production. The land should be deeply worked and brought into fine condition by ploughing and harrowing, and, if necessary, rolling. Chevalier, Golden Grain, and Kinver are good malting varieties, while the skinless variety is the best for fodder. The skinless kind will thrive with less moisture, and as it is free from awns or beards, it may be used for fodder till it is much more advanced than the bearded kinds. In the higher portions of Riverina, where the soil and rainfall are more suitable than on the lower lands, malting barley may be grown with a much better chance of success, as in the latter it is a rather risky crop.

Kitchen Garden.

Tomatoes should be trained on stakes and kept well tied up, all superfluous growth being checked. The vines should be watered, if possible, and well mulched. For Rutherglen bugs, or other insect pests, dust slightly with unslacked lime. A pair of vine bellows will be found the best medium for distribution.

Pumpkins, Squashes, and Melons.—Mulch and, if possible, water the vines. Keep the surface soil stirred between the rows and round the plants. Stop all superfluous growth. For insect pests, use lime as advised for tomatoes.

Cabbage and Cauliflower.—Sow seed in shaded sheds for succession. The best varieties are St. John's Day, Early Drumhead, Succession, Early Spring, and Early Summer; while of cauliflowers, Algiers, Early London, and Burpee's "Dry Weather" will give good results.

Swede Turnips.—Although late for obtaining the best results, seed may still be sown, as the lack of rain has prevented sowing at the best time. Anderson's Imperial, Skirving's Purple-top, and Laing's are excellent varieties.

Turnips.—Sow in drills—Early Six Weeks, Orange Jelly, Anderson's Model or White Stone.

Peas.—Sow a few Yorkshire Hero, Daisy, or Stanley, using a little superphosphate as a fertiliser.

Sow also carrots, parsnips, and beet.

Orchard Notes.

W. J. ALLEN.

March.

On account of the rather backward season, apples which usually ripen and are fit to pull by the middle of February will not be ready to pick this year until the beginning of March. In picking and storing the fruit the utmost care should be taken in handling, so as to avoid bruising it, else it cannot be expected to keep. If intended for export the fruit should be picked in the cool of the day or on cool days, and not allowed to stand in the sun, but should be kept in the shade of the tree until it is carted to the packing house, and here also it should be kept as cool as possible until it is packed and ready for shipping—in fact, the secret of success lies in careful handling, honest packing, and keeping the fruit at as low a temperature as possible from the time it is taken from the tree until it reaches the consumer. Never by any chance should it be allowed to stand in the blazing sun at any time, nor to be over-ripe before being picked. Generally when the seeds are well coloured it is ready to pick, and if properly stored will keep without shrivelling—that is, if they are keeping varieties.

This is the month in which to sow black tares or any other crops intended for green manuring of the orchard, and the earlier in the month the better, as the better the growth which they make in the fall the more there will be to plough in in the spring. About 45 lb. to the acre will give a thick growth, but it is best to put in with the seed about 80 lb. of superphosphate to the acre just to give the seed a good start, especially if the ground is at all poor.

Wherever citrus trees are found to be infested with red and other scales, no time should be lost in fumigating them. If the grower has no tents, but on the other hand has a spray pump, he should spray at once with the resin, soda, and fish oil, or the blue oil emulsion, recipes for mixing which have appeared in previous issues of this *Gazette*.

The French Prunes and Gordo Blanco or raisin grapes will be ripe enough to pick, and in the case of the latter where they are to be dipped, the same strength of lye may be used as for the prunes—that is, 1 lb. of caustic soda to 8 or 10 gallons of water, just on the boil. The fruit should be allowed to remain in this for about two seconds, when, if the lye is sufficiently strong, the skins will be found to be slightly cracked. If cracked too much the appearance of the fruit is spoilt. The fruit should never be permitted to become too dry before removing from the tray to the sweat-box. In the case of prunes they should be immersed in boiling water, or steamed in a retort for at least five minutes before packing—this last dip is best done on a hot day.

There is one very important work which fruit-growers should not fail to do every year, and that is, to take careful note of how the trees, fruit, and vines have succeeded under their system of cultivation and pruning. If too much wood has been left the chances are that the size and quality of the fruit has suffered in consequence. It may be that the fruit on trees or vines showed no signs or ill effect from the over-cropping until about a month or so before ripening, when instead of developing and maturing as it should, it stopped growing and gradually ripened without attaining a proper size.

This is a very important matter which growers should keep constantly in view, and at no time in the year can the result of different methods of pruning be seen so well as when the fruit is ripening, when each variety should be closely watched and such notes taken thereon as will serve as a guide for the following year's pruning. It is always well to bear in mind that trees or vines must not be overloaded if they are expected to produce regular crops of high standard fruits—which quality alone will always command the highest prices on the market, and best repay the grower whilst taking the least out of the trees or vines.

Those who are most successful in fruit-growing have found that they have had to combine a thorough system of cultivation with proper pruning and judicious manuring to attain these results. There is a time when each of these several branches of the work should be done, and by neglecting to properly attend to any one of them certain loss to the grower will inevitably follow.

Codlin moth should still be watched most carefully, and all grubs killed which have found shelter in the bandages; also, all fallen fruits should be picked up and destroyed.

Those who intend planting more fruit-trees this coming winter should not be late in preparing the soil and putting it into a fit condition to receive the young trees.

Budding young nursery stock may still be carried on during the early part of this month.

Practical Vegetable and Flower Growing

W. S. CAMPBELL.

Directions for the Month of March.

Vegetables.

The weather to about the middle of February was far cooler than is generally the case at that time of year, although some pretty warm days were experienced, and the rain, unfortunately, was but little and occurred only in scattered places in the State. A good general downpour is much needed during the month of February, and unless it occurs plants of all kinds are liable to suffer to a great extent.

Should rain fall at the end of February, or the beginning of March, the autumn will, most likely, prove a satisfactory time for the growth of many kinds of vegetables.

Beans, known as *Broad* or *Windsor*.—This is a good time to begin sowing these beans, and perhaps, generally speaking, the latter part of the month is to be preferred. They may be grown in any garden soil, but will succeed best in that of a somewhat stiff nature, and they prefer a cool to a warm climate. Sow the seed in rows from 3 to 4 feet apart, about 3 or 4 inches deep, and about 4 to 6 inches apart in the rows. The soil should be in good heart, and, if of a poor sandy nature, should be heavily manured with farm-yard dung.

There are many varieties to select from, but perhaps, for general purposes, the old Broad Windsor is one of the most satisfactory varieties. The Leviathan bears very long pods with fine beans, and is worth a trial. A writer on gardening directions should always be very diffident in suggesting particular varieties of vegetables or anything else to sow, that is, in general directions for the whole State; for there is such a vast difference in climates and soils, that one variety may grow splendidly in one locality, whereas others may prove failures. Vegetable growers, therefore, should make tests of several kinds, and a little observation will soon show which is the best variety to grow.

Beans, French or Kidney.—In warm districts only is it advisable to sow this kind of bean to any extent, for, judging from the remarkable mild summer, it is not unlikely that we may have early frosts in the cool parts of the State, and a frost will soon settle the French beans.

Beet, Red.—Wherever this salad vegetable can be kept going it should not be neglected or forgotten, and a few occasional sowings should keep up a sufficient supply. Thin out seedlings which are growing too close together and if these are taken up with a little care, they can be planted in another bed.

Beet, Silver.—This valuable plant should have been producing good supplies of leaves throughout the summer, if it has been properly

treated. Seed may be sown if young beets for planting out are required. If the soil is not naturally rich and good, use abundance of rotted dung and the yield should be good.

Borecole, Kale, Scotch Kale.—Not much used in this State where better vegetables can be grown. A little seed may be sown if plants are required.

Brussels Sprouts.—This is a really excellent kind of cabbage, and particularly suited for cool districts. Use abundance of manure when digging up ground for planting. Sow seed, and if any young seedlings suitable are available plant them out from time to time during the month.

Cabbage.—Sow seed during the month, a little, say, once a week or fortnight—just enough to keep up a supply of plants. Prick out the seedlings when they are large enough and transplant afterwards as required, but not leaving them to grow over-large when they are likely to suffer a good deal from the shift.

Cauliflower.—Seed may be sown in the same way as the cabbage, but it may require rather more care in the raising. Prick out and plant as may be necessary. Use abundance of manure and keep the plants growing without a check; and this is important, if good cauliflowers are required.

Carrot.—Seed may be sown extensively if a good supply is required, not broadcast but in drills, about 1 foot or rather more apart. Cover the seed with about half an inch of fine soil. Thin out the plants well as soon as they have grown large enough. The young seedlings are rather tender and should be kept quite free from weeds.

Celery.—Plants which have been raised for the purpose may be planted out, a few at a time, during the month. Use plenty of farmyard manure, and if the soil is dry use a good deal of water. It is necessary to take some steps to blanch the leaf stalks of celery before it can be used for salad purposes. This can be done when the plants are nearly full size, by means of boards, earth, or anything that will effectually keep out light. Celery required for cooking purposes only need not be blanched, and may be grown just as ordinary vegetables. The kind of celery known as celeriac, or turnip-rooted celery, is of much use for the kitchen, although it can be used as a salad as well. This requires no earthing up or blanching.

Cress and Mustard.—Sow seed occasionally as required during the month. If the weather is dry these plants will need a good deal of water. Liquid manure will be found useful to apply from time to time.

Endive.—This is a good substitute for lettuce, and a useful change vegetable. Seed may be sown, if plants are required, at any time during the month, and the seedlings may be transplanted when large enough to move. The soil should be well manured when it is being prepared for the plants. Set out the young endives about 1 foot or 15 inches apart. If the leaves are tied up together when the endives are full grown, the inner leaves will blanch and become tender and more pleasant for eating than if left in their natural condition.

Herbs.—Sow seed of all kinds of these useful plants, which should be grown in every vegetable garden.

Lettuce.—Sow in a seed-bed, and afterwards transplant the seedlings to a well prepared and well manured bed. Mr. Ellis, manager, Viticultural Station, Howlong, has lately tested some varieties of lettuce for me. They were Immensity and Cool and Crisp. He reports: "Immensity is of the crimped foliage type, outside leaves of a bronze or dark green, forming large, firm, crisp hearts, and should prove a first-class variety for market growers. Cool and Crisp is really an ideal lettuce of medium size, of a pleasing golden-green colour, forming close, compact hearts, flavour very sweet and crisp, and as a lettuce for private growers, or where high class is required, it is, in my opinion, all that can be desired. Both sorts were sown at the same time, but Cool and Crisp kept a firm, compact heart from ten days to a fortnight longer than Immensity before running to seed. I must say they are two first-class lettuces, and both very distinct in character and habit of growth."

Leek.—May be sown as extensively as may be required during this month in seed-bed. When the leeks are large enough to move, transplant to some ground that has been well manured for their reception. Water them plentifully during the growth if the weather is at all dry, and also apply liquid manure sometimes. The leeks should be planted in shallow trenches about 18 inches apart. Set the leeks about 9 inches apart. When nearly full grown, earth up the stems and blanch.

Peas.—In cool moist districts sow a few rows once or twice during the month.

Radish.—Sow a little seed occasionally during the month.

Rape.—The young plants may be used for salads and will be found useful for that purpose. Sow and use as you would for mustard and cress.

When planted out, like cabbage and well grown, rape will be found a good vegetable, and will sometimes thrive in certain localities far better than other plants of the cabbage family.

Spinach.—Sow seed in drills about 18 inches apart and thin out the seedlings when large enough. The soil should be rich for this vegetable.

Shallots and Garlic.—Plant out in drills about 1 foot apart some good sound bulbs of shallots in good well-manured soil. When planting press the bulbs or cloves firmly into the soil, the tops being just below the surface. Garlic may be treated in the same way.

Any tomato plants which are rotting away should be removed from the garden as soon as possible. Cuttings of good kinds which are required for fruiting early next season may be rooted without difficulty, and can be kept through the winter under protection for early planting in the spring.

Flowers.

Those who desire to plant bulbs should not forget to obtain all they require without delay, for the month of March is a good time of year to plant. Jonquills, daffodils of various kinds, ixias, anemones,

ranunculuses, tulips, snowdrops, snowflakes, sparaxes, tritonias, Watsonias, Montbretias, and other spring-flowering bulbs may all be planted, either singly or in clumps, from an inch deep for the smallest to 2, 3, or 4 inches for the largest.

Towards the end of the month sowings of all kinds of hardy annuals may be made, and cuttings of roses and other plants may be put in. The autumn is the best time of year in which to strike cuttings of roses.

If this season is satisfactory plantings of evergreens of any kind may be made about the end of the month.

Trials of Wheats at Quirindi.

Mr. John Perry, Vice-President of the Farmers' and Settlers' Association, Quirindi, has furnished the following report through the *Quirindi Gazette* with respect to the trial of wheats:—Two lb. of Manitoba wheats from the Department of Agriculture was sown broadcast early in June on new upland black soil, the plot being about 50 yards long and 14 yards in width. The wheat came up well, stooled satisfactorily, and grew very evenly to a height of from 3 ft. 6 in. to 4 ft. The straw was clean and bright, and, although other wheats near were almost completely taken with the rust, the Manitoba showed not the slightest trace. The heads filled well, and when the wheat was harvested, about the middle of December, 175 lb. of a nice sample of grain was the net return. As Mr. Perry points out, the season was a moist one, and it would be impossible to decide as to the general suitability for local conditions until the results of a trial in a dry season were seen. One thing greatly in favour of the Manitoba wheat was that it withstood storms better than any other wheat on the farm, and did not shell easily. Some Argentine wheat was also given a trial. The seed was obtained from a shipment straight from the Argentine. This was sown broadcast early in May at the rate of about three-quarters of a bushel to the acre. It stooled well, and grew to a height of from 5 to 6 feet. Although blown down considerably, with the exception of the Manitoba it stood the weather better than any other wheat, showed no sign whatever of rust, and gave the cleanest and brightest straw of any. This wheat holds a very high place in Mr. Perry's opinion, on account of its non-liability to shell in stormy weather. It gave a return of four bags to the acre, and a local miller says it is the best wheat he has ever milled; in fact, so highly does he think of it as to say that it is worth at least a penny a bushel more than any other wheat. Mr. Perry's favourite—Marshall's No. 3—grew splendidly, took no rust, and gave a return of seven bags to the acre of splendid grain. This wheat, in Mr. Perry's opinion, is the best all-round wheat for this district, and, from what can be learned, for the past season at all events, the best results in this district have been obtained from Marshall's No. 3. Gluy's Early was another wheat tried. It took no rust, and gave promise of an enormous crop, but went down before the severe storms which were encountered. Farmers' Friend was completely taken with the rust, and proved most unsatisfactory, as did two or three other varieties tried. Mr. Perry intends going in principally for Marshall's No. 3 and the Argentine, and will continue to experiment with the Manitoba, so as to give it a fair trial under all conditions.

AGRICULTURAL SOCIETIES' SHOWS, 1904.

Society.	Secretary.	Date.
Campbelltown A., H., and I. Society	A. R. Payten	Mar. 1, 2
Tenterfield Intercolonial P., A., and M. Society	F. W. Hoskin	,, 1, 2, 3
Bega A., P., and H. Society	John Underhil	,, 2, 3
Lismore A. and I. Society	T. M. Hewitt	,, 2, 3
Newcastle and District A., H., and I. Association	M. A. Fraser	,, 2, 3, 4, 5
Robertson A. and H. Society	R. G. Ferguson	,, 3, 4
Port Macquarie and Hastings Dist. A. and H. Society	J. Y. Butler	,, 3, 4
Castle Hill and District A. and H. Association	R. H. Lalor	,, 8, 9
Glen Innes and Central New England P. and A. Association	Geo. A. Priest	,, 8, 9, 10
Bombala Exhibition Society	R. H. Cook	,, 9, 10
Tumberumba and Upper Murray P. and A. Society	Jack J. McAlister	,, 9, 10
Oberon A., H., and P. Association	W. Minehan	,, 10, 11
Liverpool A., H., and I. Society	J. E. Wilson	,, 10, 11, 12
Crookwell A., P., and H. Society	C. T. Clifton	,, 11, 12
Queanbeyan P. and A. Association	A. W. Moriarty	,, 11, 12
Gulgong A. and P. Association	C. E. Hilton	,, 15, 16
Cobargo A., P., and H. Society	T. Kennelly	,, 16, 17
Clarence P. and A. Society	Jas. C. Wilcox	,, 16, 17
Blayney A. and P. Association	H. R. Woolley	,, 16, 17
Camden A., H., and I. Society	C. A. Thompson	,, 16, 17, 18
Goulburn A., P., and H. Society	J. J. Roberts	,, 17, 18, 19
Gundagai P. and P. Society	A. Elworthy	,, 22, 23
Lower Clarence (Maclean) A. Society	Geo. Davis	,, 22, 23
Mudgee A. Society	J. M. Cox	,, 22, 23, 24
Upper Hunter P. and A. Association (Muswellbrook)	Pierce Healy	,, 23, 24, 25
Warialda P. and A. Society	W. O. Geddes	,, 23, 24
Cooma P. and A. Association	C. J. Walmsley	,, 23, 24
Liverpool Plains (Tamworth)	J. R. Wood	,, 23, 24
Cumnock P., A., and H. Society	W. L. Ross	,, 23
Macleay A., H., and I. Association	E. Weeks	,, 23, 24, 25
Nepean District (Penrith) A., H., and I. Society	E. K. Waldron	,, 24, 25
Molong P. and A. Association	C. J. V. Leathem	,, 30
Royal A. Society	F. Webster	,, 30 to Apl. 7
Bathurst A., H., and P. Society	W. G. Thompson	April 13 to 16
Richmond River A., H., and P. Society.	E. J. Robinson	,, 14, 15
Hunter River (West Maitland) A. & H. Association	W. C. Quinton	,, 19 to 22
Orange A. and P. Association	W. Tanner	,, 20, 21, 22
Quirindi District P., A., and H. Association	W. Cadell	,, 27, 28
Wellington P., A., and H. Society	A. E. Rotton	,, 27, 28
Central Richmond River (Coraki) Agricultural Society	D. Cameron	,, 28, 29
Upper Manning A. and H. Association	W. Dimond	,, 28, 29
Moree P. and A. Society	S. L. Cohen	May 3, 4, 5
Dungog A. and H. Society	Chas. E. Grant	,, 4, 5
Coonamble P. and A. Association	F. C. Lamotte	,, 11, 12
Nyngan and District P. and A. Association	R. E. Burns	,, 18, 19
Walgett P. and A. Association	Thos. Clarke	,, 25, 26
Cobar P. and A. Association	J. M. Scott	,, 25, 26
New South Wales Sheepbreeders' Association	A. H. Prince	June 29, 30; July 1, 2
Hay P. and A. Association	G. S. Camden	July 21, 22
Narrandera P. and A. Association	J. F. Williams	Aug. 3, 4
Forbes P., A., and H. Association	N. A. Read	,, 3, 4
Parkes P., A., and H. Association	G. A. Seaborne	,, 10, 11, 12
Grenfell P. and A. Association	Geo. Cousins	,, 25, 26
Young P., A., and H. Society	C. H. Ellerman	Sept. 6, 7
Junee P., A., and I. Association	T. C. Humphrys	,, 7, 8
Temora P., A., H., and I. Association	W. H. Tubman	,, 13, 14
Albury and Border P., A., and H. Society	Walter Johnson	,, 13, 14
Yass P. and A. Association	Will Thomson	,, 15, 16

[4 plates.]

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Mixed Farming at Wagga Experimental Farm.

W. H. CLARKE.

SHEEP ON A WHEAT FARM.

THE experience of nearly every one who has endeavoured to make a livelihood from the soil is that, in districts of irregular rainfall, it is almost impossible to depend entirely upon one line of farming. A good many farmers certainly do devote themselves entirely to the

Lincoln-Merino Ewes at Wagga Farm.

production of wheat, and a large number of them, situated as they are at great and expensive distances from markets, have little or no choice so far as a second market crop is concerned. To demonstrate how sheep can be utilised as a second string to the bow of such farmers, a small flock is kept at the Wagga Farm.

Five hundred Lincoln-Merino ewes, which are bred with Shropshire rams for raising early lambs for market, were purchased in October, 1901, at 11s. per head. In the following year, 1902 (severe drought), their earnings were £253, in the shape of lambs and wool. During the year 1903 the earnings of these ewes, with the addition of others, bringing the total up to 539, were as follow :—

	£	s.	d.
Wool	140	15	5
Mutton	3	0	0
Lambs sold	202	9	11
	£346	5	4
Value of lambs on hand at time of taking these accounts	112	10	0
	£458	15	4

The charges for wages (6s. a day of eight hours) for management of the flocks during the twelve months, and including shearing expenses and freight on wool, amounted to £36 2s. 10d., leaving a

Stud Flock of Pure-bred Shropshires at Wagga Farm.

balance of £422 12s. 6d. The capital invested in this flock, purchased as will be noticed at a pretty stiff price, amounts to £296, and the pure-bred Shropshire rams, of which more are maintained in the stud flock at Wagga Farm than would be needed on an ordinary farm, brought the total up to the sum of £350. The ewes surviving out of the original purchase are worth to-day £480.

There are plenty of farms in the more arid wheat districts where as much as £350 have been expended in one season in the preparation and sowing of a single wheat crop. If that crop fails there is at the end of the year nothing to show for the expenditure, and the farmer is simply £350 to the bad. But if half, or a portion, of the £350 were spent in the purchase of sheep and in providing for them, and the balance in the preparation and sowing of half the area of wheat,

Shropshire X Lincoln-Merino Lambs at Wagga Farm.

it is practically certain that the farmer at the end of the year would find himself well in pocket. Even if the season should prove to be a most disastrous one, in which neither the wheat nor the sheep could

live, the division of investment would be better; because, while for £350 invested in a wheat crop alone, there would be absolutely nothing to show, there would be, for the sum invested in sheep and the provision for them, at least the animals themselves, or some of them, or their skins in an extreme case, as well as the little improvements about the place in the shape of fences, yards, &c., that the presence of sheep call for.

After the first year, and with anything like decent seasons, odd crops might be grown and reserves of cheap fodder accumulated, so that no matter how severe the drought might be the couple or three hundred sheep could be kept going as they were at Wagga Farm in 1902, and turning in something all the time. If a farmer, however, were tempted to stock over the limit for which in the event of a bad season he could provide, there would almost certainly be disappointment and loss.

If one takes the trouble to go into the actual figures, looking at both sides of the farm ledger, and taking into due consideration the amount of capital invested in a small flock of sheep and the provision for them in the shape of fencing, standby fodder, and expenses of management, it will not at first glance be clear that in a really good season a man can do better by dividing his capital and labour equally between sheep and wheat. In fact, in a very favourable season, there is hardly any question that a man with 300 acres of, say, a 640-acre block under wheat, would get a bigger monetary return for the year than would be possible from, say, 150 acres of wheat and 200 sheep. But not every year, nor anything like it, is favourable for wheat; and in a run of ten years the man who combines the breeding of a small flock of mutton sheep with an area of wheat perfectly within his control, will find himself much more in pocket than he would have been had he depended entirely upon wheat. The profit in sheep on a wheat farm in a district of irregular seasons lies not only in the cash they return directly, but in the returns and savings that arise indirectly from their presence on the farm. In the first place, they are the scavengers of the fallow land, eating and turning to profitable account weeds that rob the crops of nutriment and moisture, and so diminish the fertility of the soil. Then their manure, which costs nothing to spread, is a consideration in maintaining the productiveness of the wheat lands. The straw, and all sorts of waste fodder, could, by the addition of a few side crops or a little lucerne that could be grown at trifling expense in the slack times on the farm, be used up advantageously, and the farmer would find that his position would be rendered infinitely more secure against adversities of season, by reason of the more systematic way in which he would be able to spread his operations over a wider period of time. As it is with wheat as a single crop, the farmer's work comes in two big rushes of sowing and harvesting, with nothing more profitable than endless anxiety to fill in the intervening time.

During the dry season the Lincoln-Merino ewes, the pure-bred Shropshires, and their crosses, proved to be remarkably hardy. As a matter of fact, the pure Shropshire lambs made better growth

during the drought year than in that just closed. The crossbred lambs, however, did much better during the past year than in the drier year. Mr. McKeown attributes this state of affairs to the fact that in the better season the Shropshire ewes put on very much flesh, while the crossbred ewes did not become so fat, and their lambs did not suffer in consequence.

The stud flock of pure Shropshires consists of one ram bred by Mr. J. T. Burbury, of Tasmania, by the well-known sire Champion Corston Ruler; and one ram bred by Mr. A. E. Mansell, Tasmania, now, but only recently from England, by Wild Rose, of the Montford Dream strain. The ewes are by such well-known sires as Stars and Stripes, Balaclava Hero, Roxburgh Prince, Alick's Choice, Braeside Prince, Champion Royal Blood—winner of the championship in the English Royal Agricultural Show. Several of the ewes have won prizes at Victorian shows, and a number of the dams of these sheep have been winners at the Royal Agricultural Shows at Melbourne and Adelaide.

From 12 months ram lambs bred in this stud flock Mr. McKeown has cut up to 18 lb. wool; and from ewes of a similar age 6¼ lb. to 10 lb. wool; but mutton is the first consideration in the management of sheep on the farm.

A strong demand has set in for pure Shropshire rams and ewes, both for stud purposes and for crossing with other breeds for the production of lambs, and there is ample evidence that this demand has been strongly influenced by the success which has attended the tests conducted at the Wagga Farm during the past two past seasons. As it is now, the manager cannot supply the demand. Wherever these sheep have been tested in the Riverina district they have been pronounced to be an unqualified success, and in the Sydney market recently the Shropshire crosses fetched the highest average prices at Flemington.

Ensilage.

Natural Grasses and Herbage.

At the Wagga Farm there are to be seen stacks containing 280 tons of silage made from the natural herbage, consisting of trefoil and grass, chiefly Stipa and barley grass, that was stacked close to where it was cut. After allowing for a considerable unavoidable waste, the fodder thus conserved cost 2s. 9d. per ton. The mowing machine and horse-rakes were used effectively. The stack, which is shown in the accompanying illustration, looked splendid in February, and gave forth a most appetising odour. It is Mr. McKeown's intention to keep this stack intact as long as circumstances will permit, and then, when at length the stack is opened up, to keep a careful account of the condition of the silage and its feeding value for sheep, horses, and cattle. Such information will be invaluable in connection with the elucidation of important problems that confront the pastoralist as to the practicability of this means of conserving fodder for standby purposes.

Cultivated Crops for Conservation.

Barley and Vetches were grown at Wagga Farm for ensilage last season, and 80 tons of this fodder has been conserved. The crop proved to be more expensive than grasses or wheat to handle, being so spongy, but the cost per ton amounted to only 5s. 8d. for production of crop, cutting, carting, and stacking. It was not chaffed. While at Wagga the writer had an opportunity of seeing some of this silage fed to dairy cows and young stock. It was of a rich light-brown colour, deliciously fragrant, and every stalk of barley and haulm of vetches carried flag and leaves full of juice so well conserved that the material could be handled without wetting the hands. In some

Stack of Native Grasses and Herbage Silage at Wagga Farm.

stack silage made in the coastal districts from succulent crops like barley and vetches, a very considerable proportion of the juices are lost in a thick, treacly stream that oozes from the bottom of the stack, but at Wagga this juice, which contains so important a portion of the nutriment and palatability of the fodder, is retained. Stock eat it greedily, and if it does cost a little more to handle and save the barley and vetches combination is well worth the extra expense.

Wheat.—A form of silage more likely to be largely availed of when the practice of keeping a small flock of sheep as an adjunct to sheep-farming becomes more general is that made from wheat. It should also be worthy of attention on the part of those who desire to conserve standby fodder for large flocks. At the Wagga Farm there is now to be seen a hundred-ton stack of wheat ensilage, which cost 4s. 4d. per ton. The crop was cut with the reaper and binder whilst still green and succulent and the grain in the dough stage. A crop

cut in this way facilitates the cartage, the bound sheaves being so much more readily and speedily handled than loose green stuff. In stacking the bands were cut, an operation involving little labour, and enabling the material to be more firmly consolidated to exclude air. If the sheaves were left uncut any little advantage arising from more speedy building of the stack would be more than counterbalanced by the loss from waste arising from the ingress of air in the spaces between each sheaf on the sides and ends of the stack. As to the value of wheat ensilage for sheep, Mr. McKeown states that as a

Students building Ensilage Stack of Natural Herbage at Wagga Farm.

milk-producer for ewes it would be slightly inferior to green pasture. The advantage in favour of the green pasture would be that the sheep would get a variety in their diet which they would not obtain in wheaten silage; but then, if there were any grass at all, or if the principal stores of conserved or purchased fodder consisted of wheaten hay or straw or scrub, the wheaten ensilage would be an invaluable supplementary food, and take the place of natural pasture to a very considerable extent.

Sorghum.—Mr. McKeown has a good acreage under sorghum for ensilage. The varieties are Early Amber Cane and Sorghum Saccharatum (black-seeded). The latter has the advantage of reaching maturity sooner than Amber cane, and is on that account a safer crop when the amount of moisture is limited. It is estimated that the return from these crops will amount to 150 tons of silage.

In summarising his conclusions as to the most economical and reliable means of providing standby fodder on a large scale in such districts as the Wagga Farm is representative of, Mr. McKeown recommends:—

1. The growth of wheats, such as Zealand, White Essex, White Lammas, and White Tuscan, for hay. Such crops to be sown before the grain crop—from middle of March to middle of April if possible, and

harvested when the ears are formed, but while the flag is still green. Hay made at this stage is not only more palatable, but as a fodder for sheep in a dry spell, when there is little or no green grass or herbage available, is more nutritious on account of the greater ease with which it can be digested. The absence of ripe grain is also an advantage in long storage, because there is not the attraction for mice and other vermin. In harvesting and curing the hay the reaper and binder is used, it being possible in the dry atmosphere of the Riverina district to perfectly cure the hay in the bound sheaf. Some sheaves of last season's hay from the Wagga stacks were carefully examined in February, *i.e.*, about four months from date of stacking. The colour was a bright, light green, absolutely even throughout the sheaf, and the flag was not in the least wilted or brittle. To the feel the fodder possessed the silkiness and latent juiciness which is characteristic of perfectly-cured lucerne and English meadow hay. This is a feature that a good many hay-makers do not succeed in securing in their hay, but which is of extreme importance as affecting its keeping qualities and digestibility. There was not the slightest trace of the heating, mould or discolouration which is so frequently to be noticed in sheaf-cured hay in the coastal and other districts which are not often favoured with good hay-making weather.

In stacking, the sheaves are laid heads inwards so that there is practically no waste in the best portion of the stalks, and the stacks can be built expeditiously and stable enough to stand for years if need be. The thatching of stacks of hay in the sheaf is also a more simple matter, so that from a purely business point of view the whole system has much to commend it. Moreover, anybody who carefully inspects the hay stacks at Wagga Farm, and also the details of cost of production, amounting to little more than 12s. a ton, must realise that this mode of making provision for time of scarcity is not only a safe undertaking, but is an economical one, because a ton of perfectly-cured and carefully-preserved fodder, of which every particle is edible, will undoubtedly go much farther than several tons of rough, sapless stuff of which sheep would waste as much or more as they digested.

Turkeys as a Minor but Good Source of Income to the Wheat Farmer.

In the experience of the Manager of the Wagga Farm, turkeys are, in proportion to the capital invested and cost of management, as profitable as anything about the place.

Mr. McKeown got some turkeys for the farm simply because he has rather a fancy for these birds, and by degrees, as time went on, he began to realise that not only did they adapt themselves admirably to the conditions and climate of the Riverina, but that they throve amazingly. It is the common experience of many in the districts

which are favoured with fairly good rainfall, that one is very fortunate to be able to rear even a small proportion of turkeys that are hatched, the birds dying off in their young stages in a most disheartening way. At Wagga, however, the proportion of losses among the poults is comparatively small, the drier conditions and extended run being conducive to good health. As an instance of the return derivable from a flock of turkeys in localities similar to Wagga, Mr. McKeown states that the value of stock raised for the twelve months ending 31st December, 1903, was £81, and it was impossible to supply all the demands for eggs for setting and for birds for stud purposes. The flocks are culled at the farm, and only those birds which reach a high standard are retained for stud use on the farm and sale to those who wish to go in for breeding the best quality of turkeys. Last year lots of the big birds which were culled and sold for table at 18s. 6d. per couple could have been sold for stud purposes at £1 1s. each.

Bronze Gobbler at Wagga Farm
(imported from Indiana, U.S.A..

The standard in culling hens has been steadily increased during the past three years at the farm, so that it is only the birds that are as nearly perfect as possible in colour, and which range up to the heaviest weights, that now go to breeders. Two years ago a bronze gobbler was imported from San Francisco, and this bird has had a very marked effect in improving the stock. As that importation proved to be so successful, recently another trio of a gobbler and two hens were imported from the same breeder, with a gobbler from Mr. S. D. Johnson of Indiana, the latter being probably the best bird yet introduced to the State. These gobblers cost £8 a piece landed at Wagga Farm, and it is no uncommon thing for a young bird of these strains to find very ready sale at £3 3s., while this year £5 5s. will probably be reached. The weight of the bird shown is 38 lb., and he has still a good deal to fill out.

Pigs at Wagga Farm.

In one of the daily papers recently, reference was made to the fact that in wheat-growing districts very few farmers devote much attention to pigs. The writer in question quoted, in illustration of his remarks, the fact that in many districts farmers requiring pork or bacon will make their purchases, often at a high rate, from perhaps a pastoralist or some farmer in their own district who keeps a herd, and makes a very good thing out of it. When one realises how really dry conditions are in a district with at best a 20-in. rainfall, it is not hard to understand that a farmer might feel quite convinced that pigs are quite out of the question, or, if kept at all, could only be maintained at a cost greater than any possible return.

Crop of White Tuberous-rooted Artichokes at Wagga Pig Farm.

Nevertheless, pigs can be kept economically on a wheat farm, and a practical demonstration of this is to be seen at the Wagga Farm. As the fodder provision is the most important point in a matter of this kind, this will be taken first.

An area of 6 acres not far from the stables and stock-yards, has been divided into six one-acre paddocks, enclosed with an ordinary rabbit-proof wire-netted fence. Two of these paddocks are permanently under lucerne, and the other four are cropped alternately with crops that become available in regular succession, and into which the pigs are turned to do their own harvesting.

These paddocks provide more food than the fifty pigs kept at the farm can eat, and from tests carried out, Mr. M'Keown is confident

active farm stallion out of a medium draught mare, and he is certainly the makings of a perfect all-round farm horse, fit to trot in a spring cart or waggon and do any of the heaviest work required of him on a

Young Horses Bred at Wagga Farm.

farm. During the severest period of the drought some of the youngsters were brought up to the stable yard, and subsisted chiefly on straw-chaff mixed with a little more concentrated food like wheaten hay and crushed grain. As a rule, colts and fillies that hang around the stables in this way get poddy-shaped and gawky-looking. It will be seen, however, that nothing of this occurred; in fact, the effect upon these colts and fillies of their hand feeding has been a good one, as they are perfectly tame and can be moved from paddock to paddock or handled without waste of time. Any one who has had to buy horses of the stamp of the two bay fillies shown above will quite realise that the price of £70 which is obtainable for them is a fair one for a pair of such generally-useful farm mares. The actual cost of such a pair of farm horses is the service fee, the loss of the use of the dams at a time well after ploughing and some months in advance of harvest, and the grass they eat in the paddocks, with, in a bad season, perhaps, a few pounds worth of supplementary food. At any rate, the whole cost would not exceed £10 apiece, allowing for an occasional mishap or futile service, and it is only necessary to endeavour to purchase horses of equal quality to realise whether it pays or not.

In a district such as Wagga, or in any wheat district for the matter of that, there are so many benefits arising out of the ability to take advantage of favourable slants of short duration for ploughing, for harvesting, and after for hauling, that teams kept in hard condition all the time confer, that it should be the aim of every farmer to grow hay and whatever fodder he can in sufficient quantity to leave no possibility of his horses getting into low condition. To grow this hay and conserve the fodder means time and money, and therefore, the best economy is to keep as few horses as possible and have those few of a generally useful type.

Clearing Operations at Cowra Experimental Farm.

GEORGE MARKS, M.H.A.C.

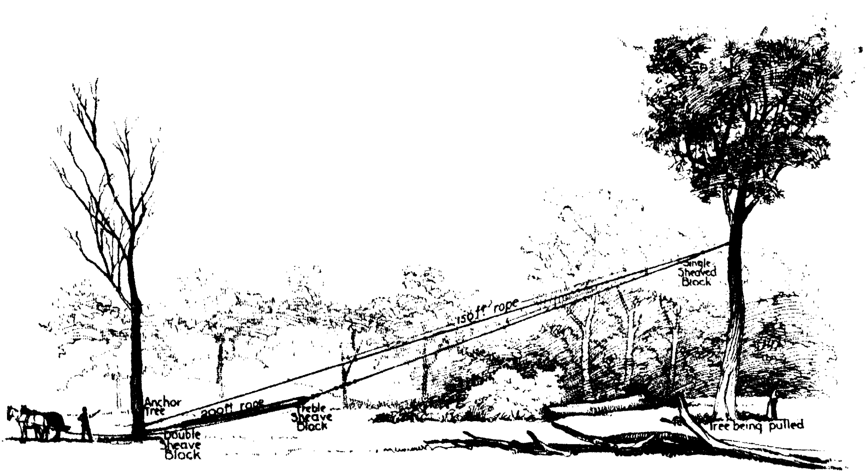
THE area set apart at Cowra for the establishment of an experimental farm consists of about 800 acres. This area formed portion of the Town Common, and is situated about 2 miles from the town upon the high lands.

From a ridge at the south-eastern corner, where granite boulders of varying sizes appear upon the surface here and there, the farm stretches in gentle undulating slopes to the east and north.

At the extreme eastern end a dam had been formed by making an embankment across one of the hollows where the sides were rather steep, and this dam forms the watering place for the numbers of stock running upon the Town Common.

The greater portion of the farm consists of a light sandy loam, and upon some of the lower portions, in the hollows, a little pipe-clay is to be found.

In many places the land is rather heavily timbered with white and yellow box, whilst in others the greater portion of the timber has been utilised for firewood, &c., in the earlier history of the common, leaving the stumps undisturbed and most carefully concealed a few inches from the surface.



Tackle, as used at Cowra Farm for Hauling Down Trees.

Clearing operations were commenced in June of last year, some 200 acres being selected for this purpose. Further areas will be cleared later on, as time and circumstances permit.

The land is typical of a large extent of our wheat-growing areas, and the method of clearing adopted will no doubt prove interesting to a large number of readers of the *Gazette*. This method has the advantage of being effective, and the apparatus required is not expensive.

The following tackle is required :—

200 ft. of 2 in. circumference wire rope.

150 ,, $2\frac{1}{2}$ in. ,, ,,

Two pieces of 20 ft., 3 in. circumference wire rope.

Three pulley blocks, size of sheaves, 8 in. x 2 in., viz., 1 treble sheave, 1 double sheave, 1 single sheave.

The above outfit, with the necessary hooks and eyes spliced on, may be obtained from any of the leading houses in Sydney for under £12.

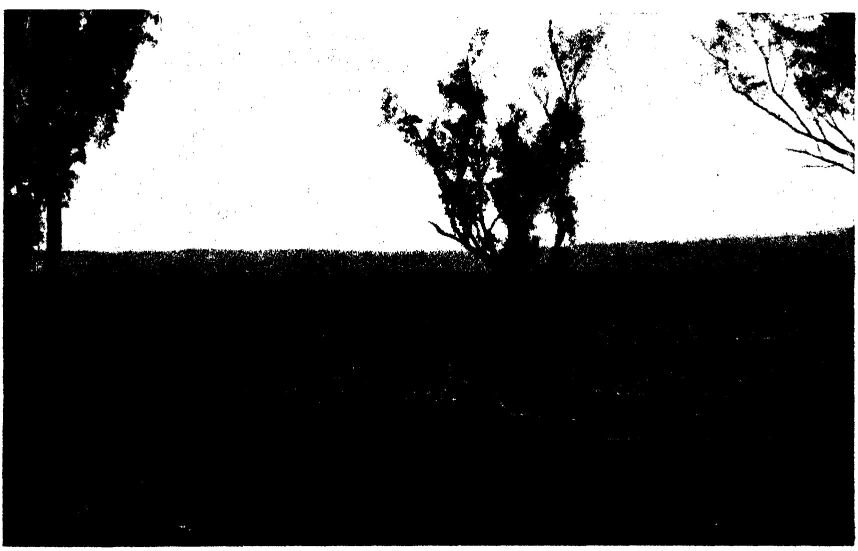
Clearing Operations, Cowra Farm showing Tree oeing Pulled Down by means of Tackle.

One of the short pieces of 3-inch rope, with the single sheaf block hooked on, is placed round the barrel of the tree that is to be pulled down, a ladder being brought into requisition to fasten the rope as high as possible. The 200 feet rope is reefed in pulleys of double and treble sheave blocks. The double block is hooked on to the other short piece of rope, which is then fastened round the butt of a neighbouring stump or tree, on the side on which it is intended to pull the tree. The end of the 150 feet rope is hooked on to the treble block, passed through the single block attached to the tree, and after the slack is taken up, is anchored by winding it round the butt of the stump or tree, where the other block is anchored, or if the stump or tree is small and not likely to stand the strain, to another tree in the

line of pull. A pair of strong steady horses is hooked on to the end of the 200 feet rope, and everything is then ready for the pull. The slack is taken out of the ropes, and by means of a strong steady pull, the tree will come down.

The side from which the tree will be pulled will depend upon the shape and lean of the tree, the slope of the land, the direction of winds, if any, and the nearness or otherwise of anchor-trees.

When the ground is soft and in good order, as is the case after or during rains, green trees up to 2 feet in diameter may be pulled down, taking almost every root with them without easing; and dry trees with sound barrels may be pulled down any size. If the ground is dry and hard, or the trees are extra large, it will be found necessary to ease them by removing the soil around the butt of the tree to a depth of a couple of feet, and perhaps cut some of the larger roots. It will thus be seen how important it is to take advantage of any wet weather, thus effect-



Clearing Operations, Cowra Farm; showing Trees as Pulled Out with Tackle.

ing a great saving of labour. Five men and a pair of steady horses could pull down about five acres of ordinary timber in a day.

In the case of stumps, or trees with hollow or defective barrels, they should be grubbed round well before commencing to pull, as there is often not the same leverage obtainable, and should the tree break off level with the ground, the butts and roots would have to be taken out in the ordinary way, thus necessitating a great deal of extra labour.

All blind stumps and roots that may have been cut in easing the trees are then taken out to a depth of 18 inches from the surface—a depth that will not interfere with future ploughing, and, if necessary, subsoiling of the area. These should be taken out thoroughly and

well, as it may save some broken ribs or chains when the first ploughing takes place; but no matter how well this has been done the plough will be sure to detect some stray ones.

The timber is a valuable asset on the farm, and nothing is being burned that is of any use. The practice of burning off everything that is not required at the time of clearing cannot be too strongly condemned, and yet how often do we see valuable timber ruthlessly destroyed simply because there is no immediate use for it. Trees having suitable barrels are being cut into lengths suitable for posts of barns, sheds, and ordinary fencing posts. These will be stacked in some suitable position, out of the way, and utilised as required. All portions not suitable for building or fencing purposes are cut up into lengths for firewood and stacked. Where the supply is much greater than what is required or likely to be required for some time to come a portion of it may be sold.

The boughs, leaves, roots, and otherwise useless timber are then burned, and the ashes from these spread evenly over the surface make a very good fertiliser.

In the clearing of this farm advantage has been taken of the native timber by leaving belts undisturbed in suitable positions for shelter purposes. In selecting these belts a number of things have to be taken into consideration, viz., the situation, aspect, prevailing winds, class of farming intended to be carried on, class of timber, &c.

This matter of providing suitable shelter belts has not received the attention it should have had amongst our farmers, and the ill-effects that follow the wholesale destruction of timber are already being severely felt in many districts. The area devoted to this purpose need not necessarily be large, and the benefits to be derived from having such belts in suitable situations on holdings must be apparent to every one.

By a little careful consideration and forethought during the clearing operations, a great deal of expense may be saved in later years. Everything that is of value should not be ruthlessly destroyed, and if placed in proper places will take up very little room, and be always handy when required.

Noxious Weeds.

Solanum rostratum, Duval.—This bad weed, first recorded for Australia in the *Gazette* for March, p. 246, as having been found at Boggabri (between Werris Creek and Narrabri), has now turned up at Yass, on the Southern Line, in a diametrically opposite direction. I am afraid that this bad weed may now be expected in many other localities. This incident behoves landowners to send suspicious looking plants for determination. It will be figured later on.—J. H. Maiden, Government Botanist.

Asparagus Culture at Bathurst Experimental Farm.

R. W. PEACOCK.

At this farm $1\frac{1}{2}$ acres are under this crop, and it was planted in half-acre blocks. The first half-acre was planted in 1896, and is at present in its prime; it was cut for twelve weeks during this season. The second was planted in 1900, and yielded about half the quantity of the oldest area; it was cut for eight weeks. The area planted in 1901 was cut for four weeks. The 1900 and 1901 beds, comprising an acre, were in point of yield not equivalent to the half-acre of 1896.

The weather during the cutting season proved much cooler than in ordinary seasons, and the cutting was extended over a longer period than would otherwise have been the case. The season was not a favourable one for this crop on account of the cool weather. The value of the crop from the area was £79 15s., which could be reasonably expected from 1 acre of asparagus in its prime. The prices obtained were wholesale, and ranged from 4s. to 5s. per dozen bunches. After deducting cost of cultivation, marketing, etc., a margin of profit from £40 to £50 per acre could be obtained.

From these figures it will be seen that this crop is worthy of more attention than is ordinarily given to it. A few of the reasons why it is not more extensively grown are that no return is obtained for the first few years, and also the impression that it is a difficult crop to grow, requiring a great amount of hand labour. The ordinary Australian farmer does not interest himself in such crops, and leaves them rather to the professional market gardener.

In France and America, where this crop is grown very extensively, the methods employed are calculated to bring this crop into the province of the farmer. In America, asparagus farms of several hundred acres in extent are not uncommon, and the profits from them very satisfactory. This has been brought about by the application of new methods of culture, which allow of the use of machinery.

As I have had many inquiries respecting the growth of this crop, the following has been written to help those who are desirous of attempting it:—Asparagus is a branching herbaceous plant, attaining to the height of from 5 to 6 feet. It is a perennial, possessing a large root stock and fleshy roots, in which it stores nutriment to tide it over the winter. It is upon the vigour of this root stock and root system that its value depends, thus enabling it to send up, upon the return of warm weather, quantities of young sprouts, which are used extensively as a vegetable. Its period of most active growth is during the summer, it being dormant throughout the winter.

Varieties.—Of the edible species, there are several of what are considered distinct varieties. These are probably the result of differences of soil, climate and culture. Of the varieties grown at the farm, Conover's Colossal has proved the superior; the others being Erfurt Giant, Giant Dutch, White Mammoth and Camden Park.

Choice of Soil and Situation.—Asparagus can be grown on a variety of soils, in fact any that could be made into a good garden loam. It thrives best upon sandy loams, moderately deep, and rich in vegetable matter. Heavy clays, and those with a hard pan, or any that are cold and wet should be avoided. Soils containing stones are undesirable, as such interfere with the cutting and cultivation.

Situation.—As asparagus requires all the sun it can get, the land should have a Northerly aspect, and not shaded by trees and shrubs.

Preparation of the Soil.—Soil which has been worked deeply and manured heavily with farm-yard manure for root crops, and kept free from weeds, is most desirable. The land should be subsoiled to the depth of from 18 to 20 inches, excepting in soils which are loose and friable to that depth. The old method of trenching to the depth of 24 to 30 inches is not practicable in field culture, nor is it necessary. Asparagus is a deep-rooted plant where the conditions are favourable for such—the roots of the eight-year old plant in Fig. I had gone to the depth of 4 ft. 4 in. The deeper the working of the soil the deeper is the root development encouraged. The land should be thoroughly worked during the autumn and left to mellow during the winter, when it should be again ploughed and drilled ready for the reception of the roots in the early spring.

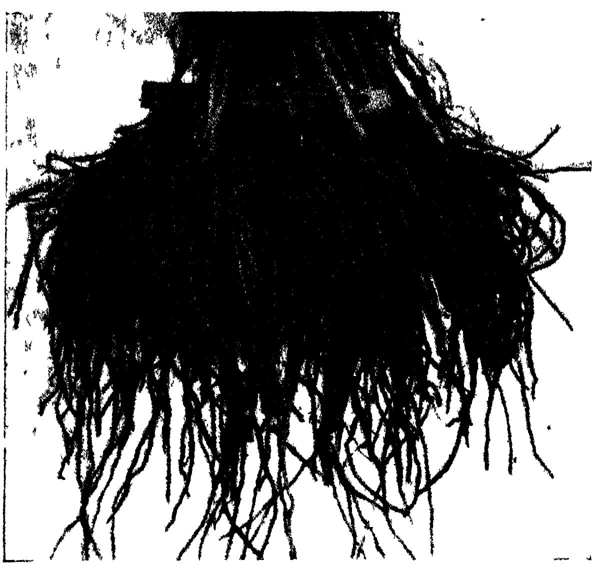


Fig. 1.—The root-system of a plant of asparagus planted at Bathurst Farm in 1896—eight years from seed.

The raised bed method as generally practised in garden culture is not to be recommended under Australian conditions, and is only permissible where an abundance of moisture is ensured. The flat field culture has much to recommend it. The distance apart to place the roots is a debatable question, and no hard and fast rules can be laid down regarding it. Where the soil is light and moisture limited

wide planting should be followed; upon richer, moister soils they can be planted closer. Closely-planted beds soon become a mass of roots, which require very heavy feeding and watering to retain their vigour, eventually the over-crowding is apparent in weak, thin, and unprofitable sprouts. As the beds or fields will, with proper care, last a life-time, it is important that the initial work be done thoroughly, and sufficient room left for root expansion. I would strongly recommend the rows being drilled 4 feet apart each way, and the roots set in their intersections. In light soils they may profitably be planted 5 feet each way. This method allows of cultivation both ways, which is a consideration in the eradication of weeds an conservation of moisture The drills should b opened out about inches deep and the root set in the bottom, car being taken to sprea the roots in their natura positions, and the crown covered by about inches of soil. If Blanche Asparagus is require the crowns should b placed about 6 inche below the surface; Green Asparagus the should be planted shallower. The natural growth of the crown forces it towards the surface and the origin depth can be maintained by applications of abundance of farm-yar manure. The drills are levelled by cultivating towards the plants.

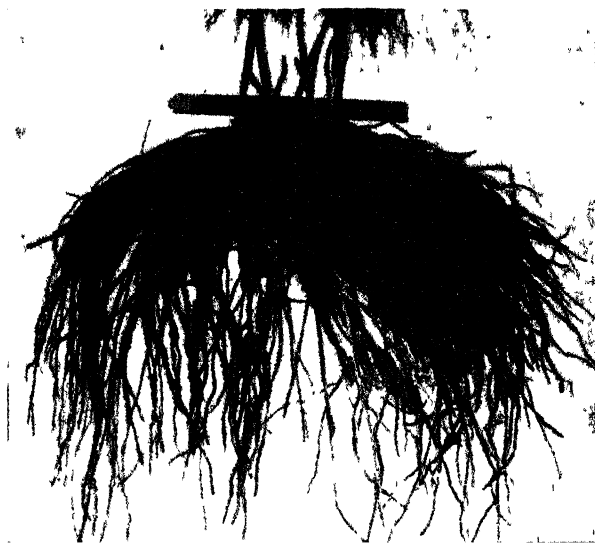


Fig. 2.—The root-system of a plant of asparagus planted at Bathurst Farm in 1900—four years from seed.

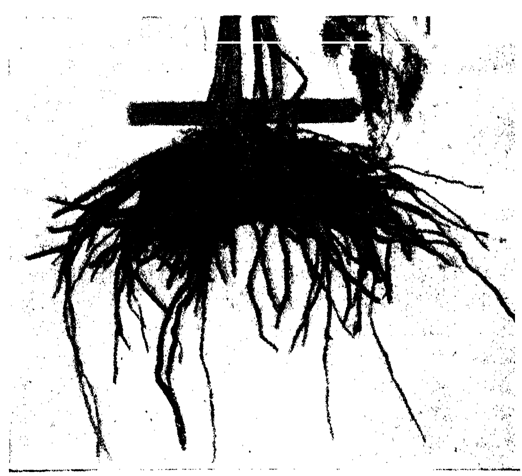


Fig. 3.—The root-system of a plant of asparagus plante at Bathurst Farm in 1901—three years from seed.

Raising Plants.—Fresh seed should be sown in the spring in well prepared soil in rows about 2 feet apart and about 4 or 5 inches in the drill. The seed germinates slowly and if soaked in warm water for twenty-four hours it will be hastened. Cover about 1 inch deep. The land should be well worked and kept free from weeds. By liberal treatment vigorous yearlings are produced. In setting out care should be taken not to expose them to the sun or drying winds. It should be done just prior to their new growth in the spring.

Selection of Plants.—Only vigorous plants should be used. Select those that have the thickest, most succulent, and vigorous stems. Choose tall rather than shrubby plants. Vigorous yearlings are to be preferred. If two-year-old plants are used choose those with imperfect flowers which do not bear seed. Seed-bearing is exhaustive.

After Treatment—First Year.—After planting out the land should be kept free from weeds throughout the summer, and frequently cultivated to conserve moisture. When the stems turn brown they should be cut down and either carted off or burned on the beds or fields. The land should be thoroughly cultivated, and where possible a liberal application of well rotted farm-yard manure applied; this can be more economically applied during the winter than in the spring. Early in the spring the land should be again thoroughly cultivated, and any artificial fertilizer applied.

Second Year.—The summer cultivation is continued, as it is most important. During the summer months the plants are preparing fresh stores of food in their roots and require liberal treatment; neglected plants are longer before becoming remunerative. In the autumn the stems should be cut off before the seeds fall, as asparagus seedlings are one of the worst pests. Where practicable, it would be wise to go through the plants and cut out all seed-bearing stems rather than cut the whole before surrendering their nutriment to the roots. It should then be treated as during the first year. If the plants have been liberally treated, a light cutting may be taken off the following spring, care being taken not to cut too hard.

Cutting.—Old established roots can be cut for about ten weeks before being let run up to stem. Younger roots must be cut lightly and treated with judgment. Throughout the cutting season, all small as well as marketable shoots should be cut clean away; otherwise they exhaust the roots, and reduce the marketable output. The method of cutting varies with the demands of the market. If blanched asparagus is required, it should be cut when the tops show above the ground, and about 8 or 9 inches below the surface; this system necessitates the earth being ridged over the crowns. In cutting, care should be taken not to injure other ascending shoots. For green asparagus, the shoots are cut when about 7 inches high, cutting about 2 inches below the surface. An intermediate method is to cut when about 4 inches high, and about the same distance below the surface. This product is then half white and half green. A great diversity of opinion exists respecting the merits of the different systems. Personally, I lean towards the green, as a larger pro-

portion is edible. After cutting—it should be subject to as little exposure as possible in the fields, and any dirt which may adhere to the stalks rinsed off; it is better not to wash the whole stalks, and the less water used the better. If the bunches are to be kept over night, they should be dipped in clean water and stood on end upon clean straw which has been thoroughly wet. The bunches should be from 8 to 9 inches long, and tied with rafia or string. If for local market, one string is sufficient; if to travel any distance, two are preferable. The stalks should be graded into different qualities.

Manuring.—Asparagus, to be profitable, should be forced, and quick growing succulent shoots should be aimed at. To ensure such, the manuring must be liberal. Large quantities of farmyard manure mixed throughout the lower layers of the soil are not necessary, excepting when required to ameliorate heavy soils. Fifty or sixty tons of well-rotted farmyard manure to the acre is a fair dressing, and can be

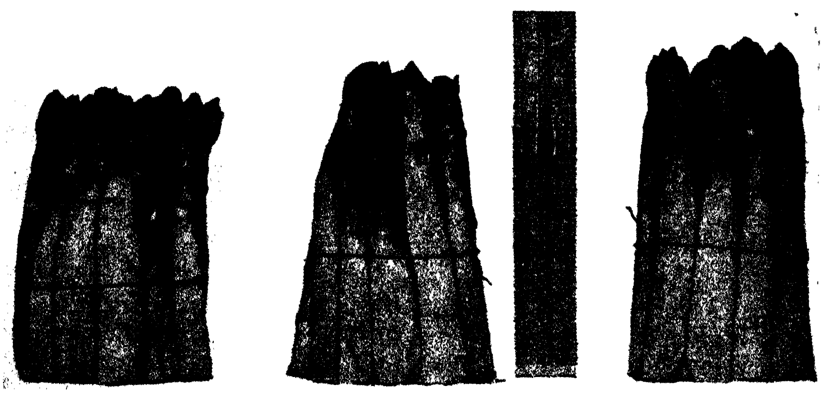


Fig. 4.—Average bunches of asparagus grown at Bathurst Farm.

applied most economically after the stems are taken off in autumn. It should be well rotted previously, to destroy seeds of weeds, and worked into the soil by consequent cultivation. Applications of commercial fertilisers should be made in the spring, directly after the cutting is finished, and prior to cultivation. Applications of the following have given good results :—

$$\left.\begin{array}{l}\text{250 lb. nitrate of soda,}\\ \text{400 lb. superphosphate, and}\\ \text{150 lb. muriate or chloride of potash.}\end{array}\right\}\ \text{per acre.}$$

Common salt is now but little used by commercial growers; the application of such manures as nitrate of soda and chloride of potash would to some extent take its place. Asparagus is unlike many other plants, and can stand a very large quantity of common salt. The mechanical condition of the soil should be kept good by applications of farmyard manure, and commercial fertilisers used to supplement it.

Injurious Insects.—Asparagus is attacked by a number of insects which feed upon the plants, the most harm done in America being due to two forms of asparagus beetles. They have not made their appearance at this Farm.

Fungus diseases.—The principal of these, causing serious damage, is asparagus rust, which also has not appeared here.

AN OLD ASPARAGUS BED.

SOME time ago when chatting about vegetables with Mr. Edward Twynam, late chief surveyor of New South Wales, he mentioned that he had an asparagus bed which was 60 years old or more, and begged me to come and have a look at it. Well, a short time ago, when visiting Goulburn, I had an opportunity of seeing this bed, and a good many more interesting things besides. It appears that some years ago Mr. Twynam purchased the old house and grounds he now occupies, about two miles north of the city of Goulburn. I expected to see some miserable looking old plants here and there, the remnants of an old garden, but my expectations were altogether "out of it." The old garden is an interesting one, and is chiefly an orchard with huge ancient apples, pears, plums, medlars, apricots and many other things besides, all in the best of health apparently. Some were bearing very heavy crops, especially the plums and apricots, the latter being ripe, and fine large luscious looking fruit, which seemed to be greatly appreciated by parrots, for there was hardly a ripe fruit which had not been bitten into by these pests. Some of the pears and apples are varieties which are now almost unknown, but nevertheless good, and worth growing, and Mr. Twynam kindly offered me wood of any I would like to have. I was nearly forgetting the asparagus, I was so interested in the old orchard. There it was, a good-sized bed with fruit trees around, the plants well grown and most healthy. One would hardly believe that asparagus had been growing here for upwards of 60 years! But there was no doubt about it. Whether the plants had renewed themselves by seed I cannot say, perhaps so, or perhaps not, I think not; but whatever may have been the case, they were not renewed by any artificial means. The soil is a deep light loam, evidently well suited for the plants, which are productive of excellent shoots every season. If they continue to be as well treated every year as Mr. Twynam treats them, it is difficult to predict how long this bed may continue to be productive.

Considering the ease with which asparagus may be grown, its excellence as a vegetable, and the length of time the plants will continue to produce good shoots, it seems rather remarkable that it is not grown more extensively than is the case at present, for it is only occasionally that it may be seen in vegetable gardens.

The name "asparagus" is derived from a Greek word which signifies a young shoot before it unfolds its leaves. It is a native of Europe

and Asia, and seems to have been in cultivation for a very long period, probably 200 years or so, before the Christian era, for an ancient agriculturist named Cato who lived then is supposed to have discovered its good qualities, and recommended the use of sheep dung as manure for the plants. He considered that asparagus beds would be productive for nine years. Pliny, who lived about the beginning of the Christian era, wrote that asparagus, which formerly grew wild, so that every man might gather it, was, in his time, carefully cherished in gardens, particularly at Ravenna, where the cultivated asparagus was so fair and large that three heads would weigh a pound, and were sold for about three farthings. Many queer things were written about asparagus by ancient writers, but although extremely interesting and perhaps of some value, space will not permit a reference to them, but I may state that a celebrated herbalist named Gerarde, who lived in Queen Elizabeth's time, said that then asparagus was eaten "Sodden in flesh-broth, or boiled in faire water, and seasoned with oile, vinegar, salt and pepper, then served at men's tables as a sallade."

I find a reference in an old work about the beginning of last century that at Westburton, in Sussex, England, there was an asparagus bed 70 years old, and this had supplied a family with abundance of asparagus all that time.—W. S. CAMPBELL.

OLD LIME FOR AGRICULTURAL PURPOSES.

A CORRESPONDENT asks whether lime that has been burned four or five years ago and has been exposed to the weather is any good for land in which fruit trees are to be planted. Also whether, if such lime were burned again, it would be improved? In reply, the Chemist states that burnt lime which has been exposed to the air for any length of time becomes converted into carbonate of lime. In this state (mild lime) it is still a valuable material, and supplies lime to the crop as well as exerting a sweetening effect upon sour soils, but the sweetening action is much less than is the case with freshly burnt lime. Mild lime has little or no action in the mechanical improvement of the soil. For this purpose, or for sweetening the soil, lime should be freshly burnt. If the lime which has been exposed to the air as described is re-burnt it will have all the properties of freshly burnt stone lime.

The Improvement of Plants by Selection.

HERBERT J. RUMSEY, DUNDAS.

WHEN purchasing seeds for our vegetable or flower garden we are sometimes inclined to be impatient at the number of varieties offered for our choice in the seedmen's catalogues, and we often express the opinion that they are multiplied needlessly. Perhaps, to some extent, this is the case, but it is the persistent hunt for improvement by the seed-growers and dealers of the world that causes the varieties to be so multiplied, and it is this same hunting that so frequently results in something extra good being given to the world. Many of the novelties that are placed on the market with a great flourish of trumpets no doubt disappear mysteriously within a few years, the reason for this is not always that they were not as good as the introducers claimed, but that they had not bred them long enough to fix their special characteristics, so that they would continue to reproduce faithfully.

Most of our common vegetables have been improved from wild straggly plants of an almost fixed type to the nearly perfect forms of dozens, or even hundreds, of types now grown.

Perhaps the most noticeable plant for illustration is the tomato. It has been improved by selection, in the short time of little more than a generation, from a weedy plant bearing small seedy fruit to its present perfection, and scores, yes, even hundreds of varieties; and while we have in this plant one that is susceptible to improvement, on the other hand we have one that degenerates just as easily. This can be proved by allowing plants of the large-fruited varieties such as Buckeye State, Matchless, or Ignotum to seed themselves and to run wild for a season or two, and we shall find fruit on them no better than the love-apple of our grandparents. The United States firm of A. W. Livingston have produced, perhaps, more valuable new tomatoes than any other in the world; at least fourteen or fifteen of our standard varieties originated with them. The late head of that firm made this fruit his hobby and pride, and such varieties as Livingston's Buckeye State, Beauty, Golden Queen, and Stone, form a fitting monument to his memory.

The output of tomato seed for one year from their establishment totalled 13½ tons, an enormous quantity when we consider that one ounce will produce more plants than would be required for an acre of ground. Through all the acres of ground requisite for producing all this seed, Mr. Livingston would hunt for some plant showing individual characteristics of value, differing from existing varieties. Seeds from these would be saved, and from such of the seedlings from these that showed the desired characteristics, seed would again be saved; and this process continued until the type had been fixed and sufficient of the seed saved to offer to the public.

Another seed-grower, Mr. H. A. March, of Puget Sound, took up the growing of the Early Jersey Wakefield cabbage-seed. The type of this cabbage was good, but not 75 per cent. of the heads from the best seed obtainable would come true to it. He grew a number of acres of it annually, selecting just a few ideal heads, these he would winter under glass, and grow his stock seed from for the next season, culling again any poor heads that made their appearance.

By this system of selection a strain was produced which within ten years was considered the best in America, and all his stock of seed was ordered in advance. In 1895 I had the opportunity of testing a small packet of March's stock seed in comparison with some of his ordinary seed, and some European seed sold in Sydney under the same name. From beginning to end the stock seed was in advance, and the European seed far in arrears. Every head from the stock seed produced a perfect-shaped cabbage of the desired type, and the ordinary lot was not far behind, but the European had a majority of loose heads shaped more like Early York, but far from the correct type.

The present head of the firm of Vilmorin, Andrieux, and Co., the great Parisian seed merchants, when addressing the seed-growers conference at the Chicago Exhibition, told of an experiment commenced by his grandfather, and still being carried on, with the object of proving that it was possible by selection to alter a fibrous-rooted plant into a tap-rooted one like the carrot. For many generations the selection of plants with a tendency to a tap-root had little noticeable effect, but after a while the improvement became more marked, until at the time of his address the seed produced more tap-rooted plants than otherwise.

A writer in the *Southern Planter* asserts that experience has proved that the old plan of omitting the tip and butt grains from the seed corn is wrong. He states that the New York Experimental Station tested for four years the relative productiveness of the different grains, with results slightly in favour of the tip kernels. The Kansas station produced the same results, while in Ohio they produced 2 bushels per acre more than the central grains. In the New York experiments the central grains outyielded the butt grains 1 bushel per acre, but in the Kansas and Ohio experiments the butt grains were more productive than the central. So that in saving only the central grains of the ear, the practice has been in favour of selection the wrong way.

Selection has taken rather a serious turn in one part of Virginia, U.S.A. On their river bank lands the surface of the ground is about 7 or 8 feet above the water-level. An ordinary variety of corn, carrying its cob 2 or 3 feet above the ground, would be destroyed by a flood of 9 or 10 feet; while with a special selection of a variety called "Cockes' Prolific," which bears its cob from 7 to 10 feet from the ground, it will take 15 to 16 feet of a flood to injure the grain.

These are but isolated instances of the improvement to be obtained by selection, but every farmer or gardener can prove for himself what can be done in this line.

While it does not pay for a man to save his own seed when a few miserable plants that have been too poor to harvest have been allowed

to go to seed, if the best and earliest (where earliness is desirable) are saved, the finest ears of wheat, the maize bearing the most regular and largest number of cobs, the finest tomato, or the best shaped carrot, he will find that in a few years he will get a strain of acclimatised seed equal, if not superior, to any that he can buy.

With pumpkins, marrows and squashes, and the different varieties of melons and cucumbers, it is a more difficult matter to save seed true to name, as, unless each variety is grown separately, and in an isolated position, the seed will be crossed. We cannot guarantee that the seed of a good pumpkin will produce equally good ones, as the pollen from the male blossoms of one variety may be carried comparatively long distances by bees and other insects to the female flower that produced this fruit. We frequently hear it said that the bees have inoculated the pumpkins or melons, but comparatively few seem to understand that the crossing had been done on the parent plant, and not in the crop under notice.

It is interesting to notice that selection in the pumpkin and squash tribe has taken an altogether different line with our American friends to what it has with us. With them a good (winter) squash is about equal to our best pumpkin (I have known people to fail to distinguish between a Hubbard squash and an ironbark pumpkin when cooked), while they advertise their pumpkins to be good for pies.

I do not wish to infer from these remarks that I ascribe all the recent improvements in plants to the results of selection, for the efforts of careful men such as Vilmorin in Paris, Luther Burbank in the United States, and the botanic experts of Kew in hybridising and crossing with a definite end in view, cannot be overlooked; but, as this is another phase of the subject, it should be considered separately. Suffice it to say that the combined results of selection of natural improvements and careful breeding have given us the great improvements in types of economic plants with which we open the twentieth century.

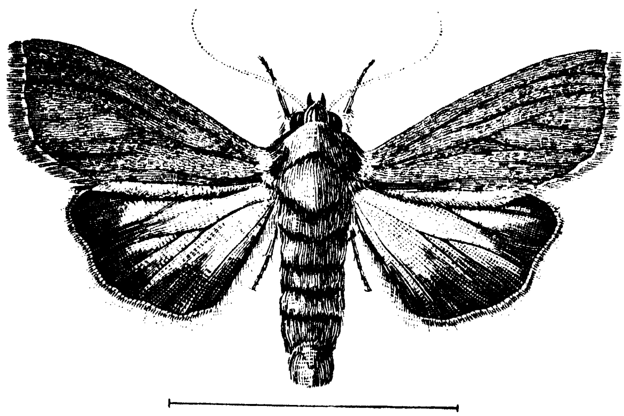
Samples of Wheats for Trial.

For the convenience of farmers desirous of trying some of the new rust-resistant wheats, including Bobs, Nutcut and others, bred by Mr. W. Farrer, Wheat Experimentalist to the Department, arrangements have been made for the distribution, on application, of small packets. Larger quantities up to one bushel may be obtained at 6s. per bushel. Applications should be addressed to the Director of Agriculture, Sydney.

The Army Worm (*Leucania unipuncta*, Haw.) in Australia.

WALTER W. FROGGATT, F.L.S.,
Government Entomologist.

THE passing season (1903-4) was heralded in with such abundant rains, after a continuous run of dry years, that the effect upon all the native vegetation was marvellous, and in places where not a single blade of grass existed less than twelve months ago, a rank growth of grass, thistles, Mexican poppies, native and introduced weeds, and herbage covered the plains, and on the river flats reached as high as one's head;



Moth.

Larva.

The Army Worm.

and all the cultivated crops responded to the magical rain in a like manner. The recuperative power of plant life was also, as might be naturally expected, supplemented with a corresponding appearance of insect pests, particularly those that fed upon foliage, such as moth and butterfly caterpillars, which are regulated by the abundance or otherwise of their food supplies. It is somewhat of a problem how insect eggs retain their vitality through the long droughts. One of the reasons, that after such periods the great increase of caterpillars is so evident, is that with the scarcity of their host insect, the countless

parasites that destroy the eggs and larvæ have vanished. Thus every egg laid by the surviving moths becomes fertile and gives birth to a grub; and when we know what an immense number of eggs a single noctuid moth can deposit, if they once pass on into the second brood unhampered by parasites the multiplication can be accounted for.

A great number of different species of caterpillars were observed, even the Scotch thistles being stripped of their leaves during the year, but only one species appears to be responsible for the wide-spread damage caused by the plague caterpillars of this last season.

The first appearance of the army worm in the State was early in October, at Singleton, where, in a paddock of about 22 acres of wheat (which the owner considered should have gone about 16 to 20 bushels) the caterpillars had taken possession, nothing but the bare stalks were standing at the time of my visit, the evening of the 14th of October. Looking over the field one saw every head that had not been nipped off occupied by from one to three caterpillars devouring the soft green wheat out of the hulls, and the owner did not obtain a single grain. Outside the whole paddock was swarming with the grubs in all stages of development, crawling along the fences in countless thousands. The Camden district was next invaded, and the army worm did an immense amount of damage to crops and grass about Camden, Penrith, Windsor, Richmond, and many other centres. On the 3rd October they appeared in numbers in the oat paddocks at the Hawkesbury College, where I collected them in all stages of growth, and a few days afterwards they had increased to such an extent that the Principal had to have all the oats cut down and carted away to the hay sheds.

One of the most serious outbreaks was in the Tamworth district, where a great deal of English barley is grown and for which they appear to have a particular liking. Mr. C. Jefferies Britten, one of the largest growers, wrote to me as follows after applying for me to visit his place while I was unfortunately away on the northern rivers:—

"I am very sorry that you were unable to come to see the extent of the havoc wrought by the caterpillars, as without seeing it was incredible. They took the whole 600 acres of my barley as if a stripper had been through it, and did great damage to the remaining 400 acres. I estimate my loss through caterpillars at fully 6,000 bags, and think that I make no exaggeration in saying that over 20,000 bags of barley have been destroyed in this district. The greatest harm was done to the early crops, the later escaped fairly well, and odd paddocks here and there were not touched at all.

"The caterpillars first showed to any extent in the last week of October and were attacking the barley that was nearly ripe. On November 11th we had 50 points of rain and then the disaster came. Up to this considerable damage had been done, but there was still 80 per cent. of the crop left, by the 13th there was none of the 600 acres to which I referred to before.

"The rain seemed to make the straw soft enough for them to eat off every head.

"To-day the brewery is full of moths, which I think come from the barley caterpillars, some of which I enclose."

The last report that I have received of their appearance is in the Bombala district, where in January they were destroying the late vegetation well into the middle of the month.

Victoria shared in the visitation and many notices appeared in the southern papers of the amount of damage done to the crops all round Melbourne and Gippsland.

All over the Darling Downs and southern Queensland through October and November they were inflicting a good deal of damage on all classes of crops.

When the caterpillars were first examined they appeared to so closely resemble the larvæ of the climbing cutworm described by me in this *Gazette* when they appeared in the Camden district in 1898, under the name of *Plegetonia carbo*, Gn., but since determined as *Spodoptera exempta*, Walker, that I thought they must be the same thing. As soon as the moth appeared it was compared with named specimens of *Leucania unipuncta* in the departmental collections taken at the Clarence River ten years ago, and found to be identical with this well-known American pest.

Leucania unipuncta, Haworth, is one of the most destructive caterpillars found in North America, and is well-known in the United States under the name of the "Army Worm," and every book I have consulted dealing with economic entomology has something to say about the damage it has caused to the farmers in the settled districts. I here transcribe Sanderson's graphic description ("Insects Injurious to Staple Crops"): "Being a species native to this country, these worms may always be found east of the Rockies on low rank growths of grass which form their habitual breeding grounds. Yet, though the moth is widely distributed, its chief injuries have been in the belts from Eastern Iowa to Maine, from Northern Texas to Northern Alabama, and east to the Blue Ridge mountains to Northern North Carolina. Even in these regions, however, the worms have never been recorded as injurious for two successive years, and the only recent outbreaks have been in 1861, 1875, 1880, and 1896, though serious injury is almost annually done in restricted localities. Only when their usual feeding places are exhausted,—or when through favourable climatic conditions, or the destruction of large numbers of the parasites which hold them in check, they increase in abnormal numbers—do they assume the marching habit and mass in armies." It is rather interesting to note what Sanderson says about them, "that the army worm seldom appears in the same places two years running."

At Singleton I noticed an immense number of our large red-legged ichneumon (*Rhyssa semipunctata*, Kirby) hovering over the fields infested with the cutworms, so that a large percentage would be destroyed by these parasites before the coming season.

I am not aware that any of our plague caterpillars have been previously identified with the "American Army Worm," though the moth appears to have been a resident of Australia for many years, and may have been introduced in fodder.

The eggs are laid upon the grass and the caterpillars are so small that it is some time before they are likely to attract any notice. When adult they are of the usual cylindrical naked type of noctuid caterpillars, with three pairs of true legs, and also furnished with four pair of well-developed abdominal claspers and anal appendages, so that they can climb and cling well, though when touched they invariably wriggle and drop down to the ground at once. They measure about 1¼ inches in length and are of a general dull olive-green tint varying to brownish-yellow; the head lighter with three parallel light stripes one down the centre of the back with another on either side, below which is a darker bar followed with an irregular lighter band along the lower edges of the segments.

When ready to pupate they crawl into the loose soil and change into the usual naked brown chrysalid, and remain in this state some time, their development being accelerated or retarded by the heat of the weather, if fine and warm about ten days completing this stage. The moth measures slightly over 1½ inches across the outspread wings, of a uniform reddish-fawn colour, varying in some cases to lighter brown with a metallic sheen (in a bright light) over the whole of the upper surface. The forewings are very finely speckled with little black scales, which form indistinct bands towards the extremities and with one very distinct mark in the centre. The hind wings silvery light-brown, darkest towards the outer margin and both pair delicately fringed with fine down. Viewed from the underside both pairs of wings are blotched with dark-brown towards the tips, and the abdominal covering of downy hairs speckled with black.

The sudden appearance of great swarms of white butterflies (*Pieris teutonia*, Fab.) passing over the eastern towns simultaneously with the advent of the caterpillar plague, led many people to believe that there must be some connection between the two visitations, and a great number of letters were received from all quarters bewailing their advent into the district, although in reality there was no connection with them. These great clouds of butterflies had been born in the far western scrubs, where the larvæ feed almost exclusively upon several species of wild caper bushes, the commonest of which are the warrior bush (*Apophyllum anomalum*) and the wild orange (*Capperis mitchelli*). The bountiful rains caused a luxuriant growth of the food plants, and account for the immense numbers of butterflies that must have bred out in the western lands, where, impelled by some mysterious instinct, they arose into the air and flew to the eastern lands. Nearly all the specimens captured near Sydney were worn and unfit for specimens, which showed that they must have travelled a long way before they reached us.

Several correspondents were most emphatic about the butterflies laying their eggs in their gardens and producing a crop of cutworms; but, with the exception of stripping the foliage off some of the examples of Capparidæ growing in the Botanic Gardens, they did no harm.

A good drawing and the life history of the common white butterfly (*Pieris teutonia*) is given in the *Gazette*, vol. x, 1899, page 74.

Remedies and Preventive Measures.

One of the most successful methods of checking the advance of any species of cutworm, and the army worm in particular, is that of ploughing a clean cut furrow round the paddock towards which they are feeding. When the caterpillars come to this obstacle in their line of march they crawl down the bottom of the furrow and follow it along. In it should be cut pot holes with clean cut sides into which they will collect in thousands and can readily be destroyed with a spade, tar, lime, or simply filling in with a rammer. Of course, the work must be done carefully and no breaks left in the furrows, but it will pay a thousandfold if done before the caterpillars have entered the paddock.

This method is advocated by Flint in an appendix of the second edition of Dr. Harris' "Insects Injurious to Vegetation," published in 1861, and had been successfully used in the great plague of army worm in the United States. Where the country is level and the caterpillars are crossing level ground, brush harrows or a roller run over the ground will kill immense numbers while they are feeding. Spraying round the crops and fields with Paris green will sometimes turn them, and with most species kill those feeding upon the sprayed plants, but its action is somewhat uncertain.

Of course, if caterpillars are already in the field or have hatched out in the growing crop, it is a very much more serious matter to get rid of them: but in many places, three years ago, when the caterpillars were just as bad and the crops were short, rolling the crops was resorted to with very good results and the crops did not suffer, but this could only be done with very late crops.

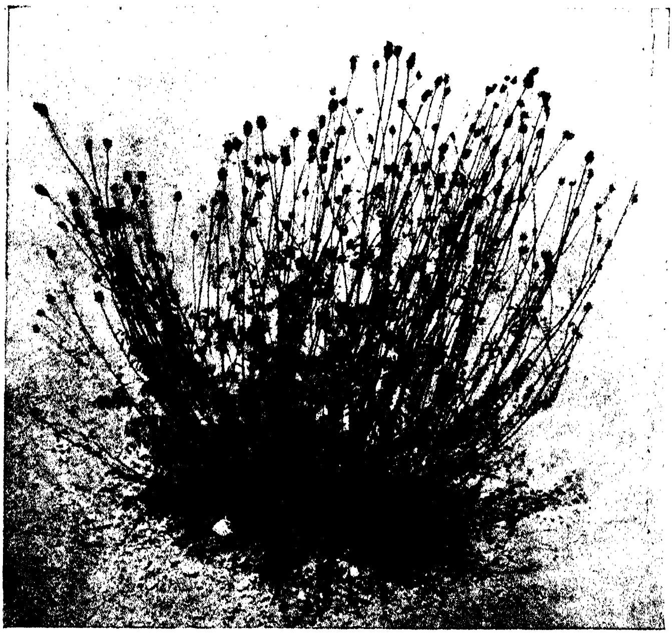
HORSES AND CATTLE EATING BARK.

MR. W. HUTCHISON, of Kinfanus, Barmedman, writes:—"I have noticed from time to time references in the *Gazette* to horses eating the bark off box trees. Your correspondent seems to think that it is from want of salt, but I do not think that can be the cause, because I have a salt trough at the foot of a box tree, and I have frequently seen my horses licking the salt and then eating the bark of the tree till they have now completely killed the tree, having eaten all the bark as high as they could reach. I have also seen them eating dry bark on a shed in the paddock. The reason I assign for it is dry feed, as I have not noticed them doing it since the drought broke. I have been told that it is the want of potash, and that a handful of boree ashes among their feed will stop them."

Sheep's Burnet (*Poterium sanguisorba*, Linn.).

Bathurst Farm.

A small paddock containing light soil of rather poor quality was sown with this fodder plant in September, 1902. It was planted in drills 18 inches apart. Notwithstanding the drought it grew well, and was fed off by sheep several times during the season. In the spring of 1903 it was let run up to seed, and was harvested in December with a string binder, the yield of dressed seed being 263 lb. per acre, which, at 1s. per lb., represents £13 3s. per acre. As the plants ripen their seeds irregularly, a large quantity had fallen before harvesting. Upon a portion of the paddock where the first foot of surface soil had been taken away the crop did comparatively well, and I do not know of any other fodder plant which would have adapted itself so readily.



Sheep's Burnet at Bathurst Farm.

It is a perennial herb, growing from 1 foot to 2 feet high. It possesses a long tap root, which enables it to withstand a considerable amount of dry weather. It remains green throughout both winter and summer. Whilst young it is a good fodder plant, particularly for sheep; when allowed to grow old it becomes somewhat woody, and is not relished. It stands a considerable amount of stocking, and is valuable in mixtures. Its principal characteristics, which should recommend it for Australian conditions, are its drought-resistance, its ability to thrive upon poor soils, and its perennial habit.

It can be sown either in the spring or autumn. The seed should be covered lightly. If drilled in, 4 to 5 lb. per acre would be sufficient; if broadcasted, 10 to 15 lb. I can strongly recommend it for the light soils of this district.—R. W. Peacock.

Analyses of Commercial Fertilisers in N.S.W.

A. A. RAMSAY AND C. R. BARKER.

1904 List.

THE accompanying list of manures obtainable in New South Wales, together with their composition as determined by analysis, and their price, is the result of revision of the list issued in April, 1903. The list is compiled in the interest of the farmers; and it is hoped that it may serve as a guide to those requiring any particular class of manure. In every case the figures given are those obtained from samples submitted to the Department for analysis.

A word is necessary in explanation of the column giving the "values" of the manures. These figures are calculated from the composition of the manures as represented by analysis, a definite unit-value being assigned to each of the fertilising ingredients. The units on which the values here given are computed are as follows:—

UNIT-VALUES of fertilising ingredients in different manures for 1904.

	Per unit.
Nitrogen in ammonium salts and nitrates... ...	12s. 11d.
,, in blood, bones, offal, &c.—fine... ...	12s. 6d.
Phosphoric acid in bones, offal, &c.—fine... ...	2s. 1d.
Potash in sulphate of potash	5s. 2d.
,, in muriate of potash	4s. 10d.
Phosphoric acid in superphosphate and mineral phosphate—	
Water-soluble	5s.
Citrate-soluble	3s. 6d.
Insoluble	2s.

PRICE per lb. of fertilising ingredients in different manures for 1904.

	Pence per lb.
Nitrogen in ammonium salts and nitrates	6·9
,, in blood, bones, offal, &c.—fine	6·8
Phosphoric acid in bones, offal, &c.—fine	1·1
Potash in sulphate of potash	2·8
,, in muriate of potash	2·6
Phosphoric acid in superphosphate and mineral phosphate—	
Water-soluble	2·7
Citrate-soluble	1·9
Insoluble	1·1

To determine the value of any manure the percentage of each ingredient is multiplied by the unit-value assigned above to that ingredient, the result being the value per ton of that substance in the manure. For example, a bone-dust contains 4 per cent. nitrogen and 20 per cent. phosphoric acid:—

4 × 12s. 6d. =	£2 10s.	= value of the nitrogen per ton.
20 × 2s. 1d. =	£2 1s. 8d.	= value of the phosphoric acid per ton.
	£4 11s. 8d.	= value of manure per ton.

It must be clearly understood that the value thus assigned, depending solely upon the chemical composition of the manure, does not represent in all cases the actual money value of the manure, which depends upon a variety of causes other than the composition, and is affected by local conditions. Neither does it represent the costs incurred by the manufacturer in the preparation, such as bagging, labelling, &c. It is simply intended as a standard by which different products may be compared. At the same time, it has been attempted to make the standard indicate as nearly as possible the fair retail price of the manure, and the fact that in the majority of cases the price asked and the value assigned are fairly close shows that the valuation is a reasonable one. To economise space, only those ingredients are given whose presence directly affects the value of the manures. Full analyses can be obtained if desired.

With regard to Part II (Bone-dusts, &c.), it will be observed that the state of mechanical division of these is given as "fine," "medium," and "coarse." "Fine" is the portion which passes through a sieve of 50 linear meshes to the inch, "medium" is the portion passing through a sieve of 12 meshes to the inch, but retained on the 50-mesh sieve, and "coarse" is the portion retained by the 12-mesh sieve.

The valuation has been made irrespective of the fineness of division, and is based on the amounts of fertilising ingredients only, but it must be borne in mind that finely ground bone-dust acts more rapidly than coarse, and that unground fragments of bone only become available as fertilisers very slowly.

In the table of mixed fertilisers, &c., it will be noticed that three columns are assigned to phosphoric acid, and a different unit value assigned to each—water-soluble, citrate-soluble, and insoluble. When bones or mineral phosphates are acted on by sulphuric acid, a portion of the tricalcic phosphate is converted into another lime compound, known as monocalcic phosphate or superphosphate. This compound is soluble in water, and it is to its presence that the rapid action of the phosphate is due. This is the "water-soluble" acid of the table. In many superphosphates, however, a considerable portion of this compound has undergone change. This change may be due to the salts of iron and alumina present, or to the length of time it has been kept, and it results in the formation of a third lime compound, bi-calcic

phosphate. This is known as "reverted" or "retrograde" phosphoric acid, and being insoluble in water, but soluble in ammonium citrate, is here given under the heading of "citrate-soluble." A value has beeu assigned to the phosphoric acid in this condition intermediate between the others. Its manurial activity has been found to be very little less than that of water-soluble acid.

As many manure manufacturers prefer to use the term "reverted," it is well to keep in mind that in this list the term is identical with "citrate-soluble."

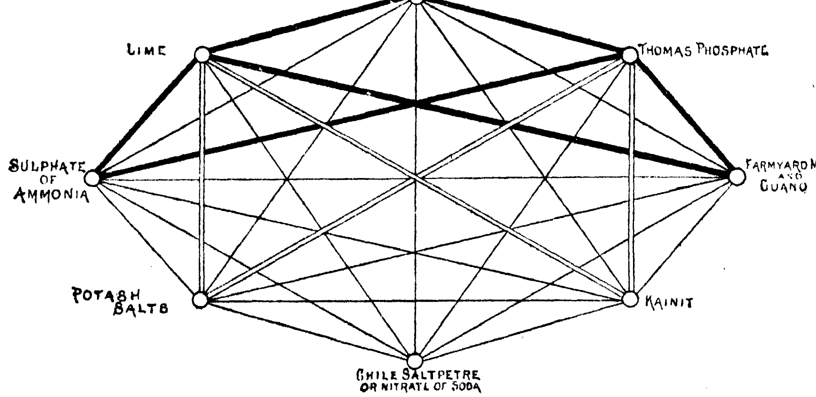
In the fourth table are a number of waste products which may in many cases be economically utilised.

WHEN purchasing a manure always insist on a guarantee of its composition as determined by analysis.

Artificial manures should be mixed with about three times their weight of dry loam, and distributed evenly.

Never add lime to a manure containing sulphate of ammonia or blood and bone manures, as in these cases loss of nitrogen results; and when lime has been applied to the land do not use such manures until about three weeks afterwards.

The accompanying fertiliser diagram, which represents in a graphic manner the points to be taken into consideration in the mixing of different manures, is being reproduced in the hope that it will be found useful to farmers who make up their own mixtures. The diagram originates with Dr. Geekens, Alzey, Germany, and is taken from an article by Mr. Leo Buring in the *Garden and Field* of 10th October. 1903.



I.—Simple Fertilisers.

Manure.	Where obtainable.	Nitrogen.	Equivalent to Ammonia.	Lime.	Potash (K_2O).	Phosphoric Acid.	Value. £ s. d.
Sulphate of Ammonia...	Australian Gaslight Co.	20·70	25·13	......	......	......	13 17 5
Nitrate of Soda...	Gibbs, Bright, & Co., 37, Pitt-street	15·00	......	......	......	......	9 13 10
Kainit	Australian Manures Co., 447, Pitt-street, Haymarket.	......	......	......	13·81	......	3 6 8
Sulphate of Potash	" "	......	......	......	49·25	......	12 14 7
Muriate of Potash	" "	......	......	......	56·59	......	13 13 4
Nitrate of Soda...	" "	15·00	......	......	......	......	9 7 6
Sulphate of Ammonia ...	" "	20·70	25·13	......	......	......	13 19 5
Phosphoric Acid Fertiliser	" "	......	......	......	......	20·06*	2 8 1
Kainit	Geo. Shirley & Co., 52 and 54, Pitt-street	......	......	......	14·88	......	3 11 10
Muriate of Potash	" "	......	......	......	59·76	......	14 8 7
Nitrate of Potash	" "	13·58	......	......	45·40	......	20 10 1
Sulphate of Potash	" "	......	......	......	52·40	......	13 10 11
Sulphate of Ammonia ...	" "	20·70	25·13	......	......	......	13 7 5
Nitrate of Soda ..	" "	15·87	......	......	......	......	10 5 0
Lime	Sydney and North Sydney Lime and Cement Co., 279, George-street.	......	......	86·32	......	......	....
Agricultural Lime	" "	......	......	38·12	......	......	....
Kainit	Paton, Burns, & Co., Commercial Chambers, corner of Sussex and King Streets.	......	......	......	14·20	......	3 8 7
Sulphate of Potash	" "	......	......	......	48·11	......	12 8 8
Nitrate of Soda...	" "	15·48	......	......	......	......	10 0 0
Gypsum ...	" "	......	......	98·68	Crystallised $CaSO_4$		....
Phosphatic Manure	" "	......	......	......	......	19·55**	2 2 4

Note.—Lime, £1 per ton, and agricultural lime, 10s. per ton, on trucks at Portland. Agricultural lime is screenings from building lime, and is not slacked.

* Of which 5·32 is citrate soluble, the balance insoluble. ** Of which ·28 is water soluble and 1·63 is citrate soluble.

II.—Bone and Blood Manures.

Manure.	Where Obtainable.	Moisture, Volatile and Organic Matter.	Insoluble Matter.	Nitrogen.	Equivalent to Ammonia.	Phosphoric Acid.	Equivalent to Tri-calcic Phosphate.	Mechanical Condition. Percentage of—			Value.		
								Fine.	Medium.	Coarse.	£	s.	d.
Bone-meal (Eastern) ...	Bowden Bros. & Co., Ltd., 18 Bridge-street.	48·91	2·12	5·39	6·54	20·82	45·45	42·8	12·8	44·4	5	10	7
Bone-dust, green ...	Australian Manures Co., 447, Pitt-street, Haymarket.	41·72	3·82	4·90	5·94	24·24	52·92	17	46	37	5	12	0
,, digested ...	,, ,, ...	42·57	2·18	3·68	4·47	23·76	51·87	33·3	58·4	8·3	4	15	5
Bone and blood manure	,, ,, ...	63·80	1·74	7·34	8·91	14·43	31·51	47	49	4	6	1	9
Blood	,, ,, ...	96·18	0·76	13·45	16·33	......	......	10	72	18	8	8	1
Blood	Geo. Shirley & Co., 52 and 54 Pitt-street.	96·11	1·44	13·59	16·50	......	......	10	72	18	8	9	10
Bone-dust, No. 4 ...	,, ,, ...	41·22	1·12	3·92	4·76	26·18	57·17	27·2	15·7	57·1	5	3	5
Gee's fertiliser, B.B. ...	Sydney Meat Preserving Co., Rookwood and Auburn.	70·72	1·06	8·31	10·09	11·29	24·64	59·5	38·0	2·5	6	7	4
Bone-dust, extra fine ground.	Paton, Burns, & Co., corner Sussex and King Streets.	39·75	4·88	2·38	2·89	22·94	41·36	99·6	0·2	0·2	3	17	6
,, raw shank ..	,, ,, ...	35·89	0·47	4·31	5·23	28·07	61·28	12·0	36·6	51·4	5	12	3
B.D. 1	,, ,, ...	38·76	0·30	4·32	5·25	25·99	56·74	20	24·6	73·4	5	8	0
B.D. 2	,, ,, ...	40·26	1·85	4·64	5·60	24·48	53·44	46·0	42·4	11·6	4	8	11
B.D. 4	,, ,, ...	39·35	1·03	4·64	5·63	25·52	55·73	6·0	28·0	66·0	5	11	1
Bone-char	,, ,, ...	22·57	1·74	0·89	1·08	30·71	67·06	73·8	25·8	0·4	3	15	0
B.B. (bone and blood)	,, ,, ...	57·38	1·49	6·88	8·35	17·32	37·81	46·0	49·4	4·6	6	2	0
Blood	,, ,, ...	96·11	1·44	13·59	16·50	......	......	10	72	18	8	9	10
,, ...	Austral Freezing Works, Ltd., Royal Exchange.	89·60	2·46	9·29	11·28	......	......	47	40	13	5	16	1

III.—Superphosphates, Mixed Fertilisers, and Imported Fertilisers.

Manures.		Where obtainable.	Nitrogen.	Equivalent to Ammonia.	Phosphoric Acid.			Potash.	Value.		
					Water soluble.	Citrate soluble.	Total.		£	s.	d.
Ohlendorff's Dissolved Peruvian Guano.		Gibbs, Bright, & Co., 37, Pitt-street	5·74	6·97	11·78	......	11·78	2·06	7	1	4
Superphosphate		Paton, Burns, & Co., corner King and Sussex Streets..	...	...	20·14	2·01	22·50	......	5	8	5
Shirley's A 1........		Geo. Shirley & Co., 52 and 54, Pitt-street	...	...	20·71	.. ...	21·20	......	5	4	6
Superphosphates	No. 1	,, ,, ...	...	...	17·28	0·21	18·69	......	4	9	6
	**	,, ,, ...	...	...	15·57	·44	16·78	......	4	0	11
	3	,, ,, ...	3·63	4·41	12·97	......	13·44	2·56	6	5	11
	5	,, ,, ...	3·42	4·15	11·77	......	11·91	6·43	7	6	0
	7	,, ,, ...	1·84	2·23	11·99	......	12·46	2·85	4	19	7
	8	,, ,, ...	4·40	5·34	12·77	2·05	15·63	2·29	7	1	4
	9	,, ,, ...	5·46	6·63	12·63	·93	13·90	3·93	7	18	0
	10	,, ,, ...	3·33	4·04	12·92	·82	14·15	7·03	8	17	7
	11	,, ,, ...	0·21	0·26	7·94	......	12·22	6·17	4	2	10
	12	,, ,, ...	4·06	4·93	8·20	2·36	19·70	2·42	6	12	6
	14	,, ,, ...	2·27	2·76	6·23	......	9·77	5·31	4	15	5
	19	,, ,, ...	4·47	5·43	6·95	3·63	18·38	2·31	5	16	8
Bone Phosphate Series.	A	Geo. Shirley & Co., 52 and 54, Pitt-street	0·98	1·19	......	11·70	32·45	......	4	14	8
	B	,, ,, ...	1·57	1·91	......	7·73	30·88	1·49	5	1	4
	N	,, ,, ...	1·68	2·04	0·96	5·77	19·70	3·63	4	11	5
	O	,, ,, ...	2·51	3·05	0·42	·24	15·64	6·86	5	0	10
Japanese Superphosphate (Buff).		Arthur H. Hasell, 2, Bridge-street	...	...	18·92	2·96	22·10	......	5	5	5

IV.—Waste-Products, Ashes, &c.

Manure.	Where obtainable.	Water.	Volatile and Combustible.	Nitrogen.	Ammonia.	Insoluble.	Lime.	Phosphoric Acid.	Potash.	Value. £ s. d.
Deposit from wool-scouring tanks. 1	Liverpool Wool-scouring Works.	....	....	·64	·78	....	....	....	·72	0 11 6
,, 2	,, ,, ,,	....	....	1·02	1·24	....	....	·16	·39	0 15 0
,, 3	,, ,, ,,	....	....	1·37	1·66	....	....	·14	·20	0 18 5
Deposit from breakers	,, ,, ,,	34·47		1·81	2·20	50·68	·85	·88	1·60	1 12 8
Sediment from wool-scouring works.	Yass	19·57		·59	·71	78·24	·97	....	·20	0 8 5
Wool-waste	....	....	....	8·15	9·89	....	....	....	....	5 1 10
"Skutch" from limed pelts	Hugh Wright, Auburn	5·32	73·42	1·80	2·18	3·61	9·36	·89	·20	1 5 4
Decomposed hair and lime	Fellmongery	9·70	57·08	6·86	8·33	1·22	26·27	....	....	4 5 9
Tan-yard refuse	Tanneries, St. Marys	6·43	33·83	2·24	2·72	21·43	26·.6	·67	....	1 9 4
Filter-press muck	Cane-mills, Broadwater	16·39	26·07	·22	·27	34·86	13·20	5·98*	·44	1 11 11
Megass	Clarence River cane	22·86	67·32	·63	·78	8·61	·30	·01	·05	0 8 2
Megass-ash	,, ,,	....	....	....	....	87·69	3·07	·16	·51	0 3 1
,,	Richmond ,,	....	....	....	....	....	1·11	·28	4·79	1 5 4
Bloodwood-ash	....	....	....	....	....	....	8·47	·27	5·25	1 7 8
Ironbark-ash	....	....	....	....	....	....	....	·82	1·53	0 7 6
Blackbutt-ash	....	....	....	....	....	....	7·27	·04	2·02	0 10 5
Red-gum-ash	....	....	....	....	....	....	....	·38	4·17	1 2 4
Spotted-gum-ash	....	....	....	....	....	....	....	·10	·70	0 3 10
Boxwood-ash	....	....	....	....	....	....	....	·67	1·65	0 9 3
Sea-weed-ash	....	....	....	....	....	....	9·27	·49	·59	0 4 0
Sea-weed-ash	....	....	....	....	....	....	6·29	1·27	17·55	0 11 11
Ash of grass-tree (*Xanthorrhœa arborea*).	....	0·86	1·78†	....	....	33·48	24·94	3·07	5·30	1 15 0
Vine-cuttings-ash	....	·49	....	....	....	60·64	11·34	1·85	3·76	1 3 2
Red-apple-ash	....	....	....	....	....	54·52	14·96	0·47	6·00	1 12 0
Ash of kerosene shale	Hartley Vale	1·49	27·93	·70	·85	67·59	....	·28	·14	0 10 0
She-oak-ash	....	....	....	....	....	8·57	42·35	8·85	2·19	0 13 0
Sea-weed, fresh state	....	80·00	....	·16	....	....	·41	·09	1·18	0 8 3
Sawdust	....	32·52	62·35	·82	1·00	....	....	1·70	·05	0 13 11
Cave-deposit, shells, &c.	Cowan, Hawkesbury River	2·11	....	·82	·99	....	35·40	1·59	·88	0 18 0
,,	Macleay River	23·03	16·01	2·43	2·95	26·77	13·88	7·40	....	2 3 2
Gypsum	Marulan		(Crystallised $CaSO_4$ = 92·64.)			4·47	....	....	....	....
Flue-deposit	Maitland	....	....	....	....	83·75	2·56	·32	·31	0 2 2
,,	Liverpool	....	....	....	....	91·17	·42	1·29	·17	0 3 5
,, from sanitary furnace	....	....	....	....	....	63·53	6·64	1·82	1·61	0 11 11

* 5 per cent. soluble in water. † Unburnt carbon.

IV.—Waste-Products, Ashes, &c.—*continued.*

Manure.	Where obtainable.	Water.	Volatile and Combustible.	Nitrogen.	Ammonia.	Insoluble.	Lime.	Phosphoric Acid.	Potash.	Value.
										£ s. d.
Night-soil mixed with lime ..	....	44·33		·74	·89	18·60	27·62	·78	....	0 10 10
Night-soil	Wagga Wagga	6·70		·03	0·4	82·19	·44	·28	·69	0 4 6
,, ...	,, ...	9·14		·28	·34	78·92	1·18	·18	·54	0 6 8
,, ...	,, ...	....		·50	·61	....	....	·64	·62	0 10 9
,, preparation, No. 1 (*a*)	,, ...	8·22		3·73	4·63	50·22	13·32	9·65	·91	4 5 2
,, ,, No. 2 (*b*)	....	7·20		1·83	2·22	29·02	6·05	4·10	·15	2 0 10
,, ,, No. 3 (*c*)	....	25·95		1·64	1·99	60·17	1·39	1·61	·70	1 8 7
Night-soil preparation, "Pinhoe" manure.	....	·92	9·54	·21	·25	57·58	14·71	1·26	·56	0 8 0
Night-soil preparation, No. 1 ..	F. Artlett, Parramatta ..	7·33	30·06	2·10	2·55	46·38	3·74	1·92	·61	1 13 3
,, ,, ..	,, ,, ..	10·11	42·59	4·97	6·03	·94	$CaCO_3$ 30·12	·39	....	3 2 11
,, ,, ..	Mr. "Halstead," O'Brien's patent.	1·54	12·36	·54	·65	77·95	....	·63	....	0 8 0
Farmyard-manure	....	67·96	22·09	·40	·49	8·16	·16	·20	·30	0 6 11
Fowl-manure	....	3·95	16·48	1·47	1·78	70·16	2·10	1·94	....	1 2 3
,, ...	....	1·54	15·23	·86	1·04	79·96	·64	·59	·33	0 13 7
Flying-fox-manure	....	1·09	35·34	3·34	4·05	50·29	1·02	0·36	1·15	2 8 4
Fish-manure	....	10·88	59·26	6·10	7·40	5·39	9·82	8·28	....	5 19 0
Sheep-manure	Liverpool Wool-scouring Works.	9·71	50·91	1·79	2·17	32·26	2·0	·91	·92	1 8 11
Bat-guano	....	14·11	17·69	1·55	·88	28·77	13·72	11·42*	....	2 5 2
Bat-guano†	....	10·86	19·65	2·24	2·72	51·95	1·75	3·55	·15	1 16 8
Bat-guano‡	....	13·70	34·35	4·76	5·78	3·30	22·28	13·04	trace	4 6 7
Bat-deposit	Cave Flat, Cooradigbee ..	5·43	12·98	·50	·61	57·64	5·60	12·12	....	1 10 6
Decayed wood (bark and leaves), bloodwood.	....	57·80		·74	·80	40·68	1·30	....	....	0 9 3
Decayed wood (bark and leaves), pepper tree.	....	79·92		·89	1·08	17·77	1·50	....	....	0 11 1
Muck from waterworks reservoir	Maitland	4·84	17·55	·74	·90	63·42	4·56	·31	·60	0 13 0
Cocoa-nut cake	Lever Brothers	8·71	85·37	3·45	4·15	....	1·40	1·23	2·45	2 18 3
Bean-cake	North China	14·52	80·32	6·77	8·22	....	....	1·33	1·99	4 17 7
Field-pea, whole plant	....	88·58	9·97	·55	·67	....	·15	·12	·49	0 9 7
Tares, whole plant	....	83·97	14·96	·73	·88	....	....	·11	·21	0 10 5
Marsh-mallow, whole plant ..	....	79·00	17·86	·85	1·03	....	....	·14	·69	0 15 0

* 1 per cent. of the phosphoric acid is water-soluble. † The total nitrogen contains 1·12 nitric nitrogen, ·84 ammoniacal nitrogen, ·28 organic nitrogen. ‡ This analysis was made by Mr. J. C. H. Mingaye, and the total nitrogen contains 1·70 nitric nitrogen, ·64 ammoniacal nitrogen, and 2·42 organic nitrogen.
a 4·86 per cent. phosphoric acid is water-soluble. *b* 3·03 per cent. phosphoric acid is water-soluble. *c* ·42 per cent. phosphoric acid is water-soluble.

Forestry.

Introductory.

ARRANGEMENTS having been made through the courtesy of the Department of Agriculture under which a portion of the *Agricultural Gazette* is in future to be devoted to forestry, it is anticipated that much benefit will accrue to this interest in having an official organ for the publication and dissemination of information relating to it.

The want of a medium through which officers might express their views on many of the problems which surround the forestry question has long been felt, and it is anticipated that the officers connected with the Department will take advantage of the *Gazette* for the purpose.

In due course it is also contemplated to obtain suggestions on different questions through this channel, and to publish in a collective manner the results of such inquiries.

Departmental changes and other items of interest will also be published in the *Gazette* with the object of encouraging that *esprit de corps* which is so essential to the success of administrations, the officials of which are widely separated.

SOME PRACTICAL NOTES ON FORESTRY SUITABLE FOR NEW SOUTH WALES.

BY J. H. MAIDEN,

Government Botanist and Director of the Botanic Gardens, Sydney.

I.

WE have no manual of New South Wales forestry, and the notes I give may be useful provisionally. Perhaps later on they may be gathered together and supplemented; in that case the arrangement may be modified.

The Seed.

Most plants originate, naturally or artificially, from seeds, and hence it is very important that the best seed, true to name, should be secured. So much depends on good seed that no trifling initial expense should stand in the way. Avoid cheap, stale, badly-saved seed. Pay a fair price for it. Of course seeds vary in their keeping power; some may be stored without detriment for a number of years (*e.g.*, wattles), others, *e.g.*, imported oaks (*Quercus*) and black apple (*Sideroxylon australe*), perish very quickly, and should be packed in charcoal or soil for transport immediately they are taken from the tree.

Most seeds have to be gathered before they are fully ripe (this applies chiefly to dehiscent fruits), or else they cannot readily be saved. For example, the capsules of the Red Cedar (*Cedrela australis*) and the follicles of the Silky Oak (*Grevillea robusta*) suddenly open, and their winged seeds fly away. This is partly the reason why these seeds are always expensive. They should, therefore, be gathered before the opening of the fruits. They can be caught on a sheet and dried out of draughts or wind or of bright sunshine.

One cannot in the space allotted deal with all kinds of seed, but caution should be exercised in regard to them,—as regards quality, their treatment, &c.

Testing of seeds.—This is a subject which is worthy of special emphasis in connection with forestry. We have not a complete seed-control station in connection with our Department of Agriculture, but agricultural seeds may be tested as to name, germinating power, and purity. The germinating power of seeds is, of course, of paramount importance to the farmer. Not only do seeds vary considerably in the length of time they may be safely kept before sowing, but there is often much variability in seeds in the same parcel through admixture and other causes. I cannot do justice to this subject on the present occasion, but I venture to refer to two excellent papers, which will well pay perusal.* Hardly less valuable is a paper by another author† belonging to the same Department, where homely appliances for the testing of seeds are described. It has long been a matter of surprise to me that seed-testing is so little practised by farmers. Of course, as regards the more difficult points that present themselves in these investigations, the farmer would do well to appeal to the Department of Agriculture for help, but, as a rule, with very little practice, and with appliances to be found in every household, he can test the germinating power of most seeds as well as anybody. And if the citizen whose purchases of seeds are limited to those required for the horticulture of a suburban garden were to adopt a similar plan, much heartburning would be saved, and the precautions of seedsmen for the supply and distribution of good seed would be promptly increased.

Industry of seed-collecting.—Most of the forest seeds collected in this State are those of Eucalypts, trees difficult to discriminate. But that does not in any way justify collectors in supplying mixed seed or seed with misleading names. I feel indignant as evidence is furnished to me of the carelessness of the suppliers of indigenous seeds. If a man desires to learn the names of his seeds, botanists will help him without fee or reward, so that ignorance can be no

* *a.* "Seed Control: its aims, methods, and benefits," by Gilbert H. Hicks (U.S. *Dept. of Agriculture*). Read before Massachusetts Hort. Soc., Feb. 8, 1896. Boston, Rockwell, and Churchill; pp. 28. *b.* "Pure Seed Investigation," by the same author, reprinted from the *Year Book of the U.S. Dept. of Agriculture for* 1894. The same botanist is author of Circular No. 6, Division of Botany of the same Dept., entitled "Standards of the purity and vitality of Agricultural Seeds."

† A. J. Pieters—"Testing Seeds at Home," reprinted from *Year Book, U.S. Dept. of Agriculture*, 1895.

man's excuse in this matter, and a man who supplies named seed of whose origin he is ignorant or careless is a delinquent of a peculiarly despicable kind, one whose wickedness can only be found out after the lapse of years, when perhaps reasonable hopes have been blasted. I would like to see the purveyors of false seed subjected to the penalties of a draconian law. Human nature is much the same everywhere, and our people are no greater delinquents in this respect than those of other lands, but I have personal experience in these matters when I say that the disastrous effects of the distribution of ill-named or bad seed are comparable, as regards agriculture, forestry, and horticulture, to droughts and pests. Planters of all kinds have quite enough discouragements of an unavoidable character without being saddled with others absolutely within human control.

Danger of planting inferior species.—Whether plantations are made by Government or by private persons, the importance of planting only useful species cannot be overestimated. I have seen plantations in Australia which should now be revenue-producing, but the timber has no known use, and forms inferior fuel. It is, in fact, unsaleable. In re-afforestation operations, by means of our indigenous trees, it is necessary to emphasise this point very distinctly. This brings me to one phase of the seed question. The selection of suitable seed is not by any means a matter resting solely with the seedsmen. Customers (official bodies and individuals) ask distinctly for seed of species which we know to be inferior. The reason of this is, in some cases, owing to the fact that through the confusion of botanical writers in regard to the merits of trees of the especially difficult genus Eucalyptus, species have received praise which is not really due to them, and planters, observing these favourable remarks, have placed their orders accordingly. The lesson to be learnt is that grave responsibility attaches to the man who, through imperfect information, praises a tree. The tendency to speak in superlatives as to the excellency of our native vegetation is growing, and should be restrained, and a man who is deceived by glowing accounts of our trees is apt to underrate them when the reaction takes place.

I think I am right in asserting that very few of our landowners have cultivated any considerable number of trees for timber. In the northern hemisphere this practice is well established, and it is a matter well worthy of consideration, by many of our country people, to what extent the planting of trees will afford profitable employment for capital and land. At the same time, as a very general rule, I adhere to my often-expressed view that we require conservation, rather than fresh planting, in New South Wales.

Desirability of raising Plants in the District in which they are to grow.

There is great advantage in raising plants in the district in which they are afterwards to be planted out, as all sorts of risks are incurred when plants are moved from a distant locality. Plants stand a better chance if raised from seed or cuttings from plants growing in soil and

climatic conditions approximating to those of their new home. Of course, a good deal of experimental work requires to be done in New South Wales, and it is not possible to predict, in many cases, whether a certain plant will succeed or not. If we do not make departures we shall not progress in human knowledge, and I do not wish to discourage experimental work, but many residents in country districts only wish to plant to a limited extent and desire to be as safe as possible.

Having obtained the seed, the next step is, at the proper season, to sow it. As in this, so in all other important gardening * operations, I recommend professional assistance to be secured wherever possible, for it is the best and most economical course. A professional gardener should always be employed for pruning and spraying, and to supervise the planting.

Public bodies which have not the funds to employ a gardener the whole year round, will find it in the highest degree desirable to employ one for one or two of the winter months, and to pay one a retaining fee to report and advise on the plantations at stated periods during the year. It is understood that what follows is only intended as a guide to those who have to rely on their own resources.

Propagation of Trees other than by Seeds.

Some plants, such as planes, willows, poplars, elms, tamarisk, may be propagated by cuttings or divisions.

Layering is a comparatively costly operation and is only practised with valuable horticultural stuff such as Camellias, Viburnums, &c.

(*To be continued.*)

Fodder Plants for Distribution.

Seeing the important part played during the late drought by trees of fodder value in preserving the life of stock, the Department of Forestry recently brought under the notice of the Minister for Lands the desirability of fostering and encouraging the growth of fodder trees by pastoralists and settlers, and in view of the probability of a succession of favourable seasons the Minister has approved of that Department propagating a large number of †Carob or Algaroba Bean, and Kurrajong trees, for distribution to pastoralists and settlers on the following terms, viz. :—

1. In sufficient numbers to plant from 1 to 5 acres (about fifty plants to the acre) to be planted in lines or clumps as the recipient may elect.
2. The site for planting to be ploughed and subsoiled to a depth of 18 inches, and to be securely enclosed with a stock and vermin proof fence.

* Most of the ordinary operations of forestry are familiar to the skilled gardener, or he is the man who, by reason of his training, is best able to supplement his own knowledge with special forestry practice.

† Note.—Carob trees will not be ready for distribution this (1904) season.

3. The Department to supply the trees and the recipient to pay freight and cost of delivery of same.
4. Should it be desired the Department will undertake the planting of trees if a guarantee, for payment of rail or coach fares of two nurserymen and their wages at 10s. per diem, be given.
5. Two months' notice, prior to 1st June, in each year to be given of intention to take advantage of the Department's offer, and the site for planting to be in every case prepared and ready for planting, not later than 1st May in each year.
6. Applications to be addressed to the Officer-in-Charge of Forestry, Sydney.

The following description of the fodder trees referred to is furnished for the information of intending applicants.

From Maiden's "Useful Native Plants of Australia."

The Kurrajong, *Sterculia diversifolia.*—Cattle and sheep are fond of the leaves and branches, and in some dry seasons have existed for long periods on scarcely anything else.

From Mueller's "Select Extra Tropical Plants."

The Carob Tree, *Ceratonia siliqua.*—Indigenous to the Eastern Mediterranean regions. It attains a height of 50 feet and resists drought well; succeeds best in a calcareous subsoil; the saccharine pods, Algaroba or St. John's Bread, of value for domestic animals. In some of the Mediterranean countries horses and cattle are almost exclusively fed upon the pods; the meat of sheep and pigs is greatly improved in flavour by this food, while its fattening properties are twice those of oil cake. Instances are on record of a tree having yielded nearly half a ton of pods in a season.

DEPARTMENTAL.

THE Minister for Lands has approved of the appointment of the following officers as a Committee to collate information and deal with the question of classification of State lands for forestry purposes, viz.:—

Mr. J. W. ALLWORTH, Chief Surveyor, Lands Department.

Mr. W. H. CAPPER, Chief Clerk, Lands Department.

Mr. R. DALRYMPLE HAY, Officer-in-charge, Forestry.

Coonamble District—From an Agricultural Point of View.

W. H. CLARKE.

For the man who desires to grow wheat on a large scale as a main crop, the tract of country traversed by the Dubbo-Coonamble railway and stretching back on either side for many miles possesses two very attractive features. The areas can be cleared for cultivation at a small cost—thousands of acres requiring no expenditure for this at all; and the several classes of rich soil embraced are naturally so friable that all cultural operations are inexpensive. Under such conditions the major portion of capital invested can be reserved for the acquirement of effective working plant, including ample harvesting machinery, which is essential to profitable grain production in districts where rainfall is not abundant, and an occasional bad harvesting season for wheat has to be reckoned upon in the calculations. To the man desirous of making a home for himself and his family by means of the intensive cultivation of a restricted area, this district affords, in addition to the advantages enumerated above, a third and, possibly, to the man of few acres, the most important advantage of all—an unlimited supply of artesian water. That is to say, from all the indications as to the formation of the country and from the actual experience in tapping the artesian flow, it is quite possible to procure, on every square mile of the country in the Coonamble district that is suitable for intensive culture, a big and permanent supply of water at a cost not exceeding £1,000. The flow from many of the bores in the district exceeds a million gallons of water per day, and as under the ordinary conditions of intensive culture about 10 to 20 acres under water is about as much as any farmer can manage properly, the flow from a single bore should meet the requirements of, at least, five farmers. That the water from these bores can be transmitted considerable distances is amply proved by the fact that in 1902—a year of extreme drought—water from the Nedgera Bore was conducted in mere furrow channels for distances up to 20 miles, losing by seepage in the dry soil and by evaporation goodness only knows how great a proportion *en route*. Even if a landholder had to pay the same percentage that the Sydney Water and Sewerage Board require for laying on water beyond the ordinary population boundary, it would not entail a large sum, and the expenditure could be regarded as an insurance policy against adversities of season, and a provision that could be turned to most profitable account in the production of bacon, dried fruits, &c.

It is now proposed to discuss under separate headings each of the crops and modes of cultivation that appear to be suitable for the respective sections and soils of this comparatively new agricultural district.

Wheat Growing.

Coming from Dubbo and extending to about Gilgandra, the country is, generally speaking, sound, red soil carrying pine and box—country that in other districts has proved to be admirably adapted for wheat. There are a few belts of ironbark, a few rather sandy tracks, and some basaltic outcrops. Both the pine and the box trees are got rid of at a very low cost, and the smaller growths, a little mallee, acacia, &c., add little to the labour of clearing. Much of this country could be cleared by means of the tackle described in another part of this issue (page 313), and judging by the experience of other districts similarly timbered, ought not to cost more than £2 per acre for virgin land or £1 per acre for rung country, every scrap of the timber being readily burned.

For the preparation of this soil, multiple furrow ploughs with mouldboards or rotary disc ploughs are more likely to prove effective than scarifiers; and almost without doubt the rotary disc ploughs, which are coming into such general and extensive use in somewhat similar districts like Narromine, will be found to be the most suitable class of implement.

Around Coonamble there are two classes of country that at once attract attention—the extremely friable dark soil of the open plain that in its virgin condition offers no greater impediment to immediate cultivation than a dense mass of herbage, grass and wild geranium or carrot; and the lighter-coloured soil which is of sandier texture and in which are to be found extensive patches entirely denuded of vegetation.

The dark soil, almost black, but of a different character altogether to the soil of what are generally called "black soil plains," is friable and spongy. In dry weather, instead of gaping in wide cracks, this soil flakes on the surface. In ordinary seasons it permits of greater indulgences in easy methods of culture than probably any soil in this or any other country. Wheat merely scattered broadcast on the surface, moistened by a little rain or even dry, and trampled in by a flock of sheep, returning crops of 2 to 3 tons of hay per acre and heavy yields of grain. At present, many, in fact almost all the growers hold the opinion that the cheapest means of making such soil ready for the reception of seed wheat, is to stir it with a scarifier. It is said by one of the leading growers in the district that the cost of this method in virgin soil is 1s. per acre for each scarification. His practice is to run the implement (drawn by four horses) one way with a narrow set of thirteen teeth, and then cross-work the area with a broader set of tines, making the cost 2s. per acre. Seed at the rate of 16 lb. per acre for early sowing is put in with an ordinary seed drill, and a large area is thus prepared and sown for a total of about 5s. per acre. To be able to do this, it is necessary to destroy, by raking up and burning, all the decaying vegetable matter—remains of spring growth of herbage on virgin land, stubble or straw on worked land—and in this way not only may the future productiveness of the soil be diminished, but its friability and capacity to absorb and

retain moisture will certainly be decreased. It was pointed out in an article which appeared in last issue that there are seasons when wheat, sown anyhow but sown opportunely according to the local conditions, will return good crops, and this is no less true of a rich district like Coonamble than it is in less-favoured localities. A grower who was interviewed stated that last season he did about half his area with the scarifier, but finding the masses of vegetable matter a hindrance to the work, he ploughed the remainder. From the whole area he reaped ten bags to the acre, and so far as he was able to judge there was no perceptible difference in growth or yield in either section. This grower fully realised, however, how delusive the results of such a season as last might prove to be, and as he is a young man who wants to maintain the productiveness of his farm as long as possible he is very much inclined to use the plough entirely in future.

The Advantages of Ploughing.

For the successful production of crops in any district of meagre and uncertain rainfall, the safest course to adopt is to be always prepared for drought. The soil that is able to absorb and retain the greatest amount of moisture is the soil which contains the greatest proportion of vegetable matter. Some soils in their virgin state contain a large percentage of this important constituent, but when they are broken up and a shallow layer of the surface is exposed to sunshine and hot winds, it is astonishing how rapidly the humus disappears. This is precisely what may occur in soils which are worked uninterruptedly for a succession of seasons with such an implement as the scarifier, which does not in any way bury or cause to become incorporated with the soil any of the vegetable matter or stubble which in its decay helps the soil to retain moisture. If ploughs, and especially rotary disc ploughs, were used to break up the virgin soil, an enormous mass of vegetable matter would be turned under to rot and form humus. A good many people seem to be under the impression that if a luxuriant growth of vegetation were turned under and allowed to become incorporated with soil already rich, the presence of so much nitrogenous plant-food in the soil would induce a tendency in the wheat to run to straw at the expense of grain and rigidity, thus diminishing the yield and increasing the difficulties of harvesting. That is a matter that remains to be proved, and it is an exceedingly difficult one to deal with, because, despite apparent similarity, every plain devoted to wheat is a district in itself, coming under influences of exposure, passing storms, modes and times of manipulation, and all sorts of trifling, but in reality important, details which govern the behaviour of soil, moisture and crops. When everything is taken into consideration, however, it is far better for the man taking new land into cultivation to turn under all the vegetable matter that Nature provides, and run the risk of an abnormally heavy crop of hay which he can put away as a standby for his own stock or dispose of for at least a good deal more than any expense he has been put to in raising it, than to incur the danger of depleting his soil of a constituent which

is absolutely indispensable for the retention of moisture and solution of mineral plant-foods. The best soil in the world without moisture will not grow anything, but the poorest of soils with moisture will, at least, produce some crop.

The Condition of Soil for Ploughing.

Some people object to an implement that will not work in wet land, and it must be admitted that in sloppy soil disc ploughs are not very effective. For the matter of that, no ploughs are. If it were only the implements that had to traverse the rich loamy soil when wet, the result would be troublesome enough, but there would be the horses—generally five or six of them—all pugging up the soil, until by the time the work is finished and exposed to a few hours sunshine the area is a mass of clods that can only be reduced to a fair state at considerable cost for harrowing. There is thus, for the man who wishes to sow his crop at a low cost, no economy in touching the land until it is exactly in the right condition, according to the composition of the soil or soils embraced in his area of cultivation. Some soils, such as the lighter and sandier soils in Coonamble district, are fit for ploughing very soon after rain, perhaps within three or four days; while the heavier darker-coloured soils would require a little more than a week to brash down nicely and not clog up the working parts. So much depends upon the time that is chosen for breaking up the seed-bed, and that time is so inexorably governed by favourable slants of weather and a farmer's resources to take advantage of the most favourable opportunities, that one cannot refrain from urging wheat-growers to confine their operations to the area that is absolutely within the control of their implements and teams.

Wet land, in a district with somewhere about 20 inches annual rainfall, is not likely to be the only thing that might delay the preparations for early sowing. The land might more often be dried out, and under such conditions a good deal of judgment must be again exercised to get the finest seed-bed at the lowest cost.

Some years ago there appeared in the *Agricultural Gazette* a few notes on the principles of ploughing, and it might prove of interest to reproduce some quotations from them which appear to be very applicable to the local conditions of Coonamble district.

"The time to plough will be determined entirely by the condition of the soil. It is a mistake to plough the land when it turns up cloddy. It is better to wait until the land contains sufficient moisture to fine it as it falls from the mould-board. The soil is like a sponge. When filled with water the soil particles are expanded, and all the interstices are filled. When left exposed to a hot sun the particles are drawn together by the rapid evaporation of the water. This explains why the soil cracks so badly in improperly drained fields. This cracking tears and breaks many of the fibrous or feeding roots of the young plants, thus cutting off a portion of their food supply. If the drying is very rapid the particles of the soil are drawn in to each other with such force as to be compacted into an almost solid mass, and it is very difficult to reduce it again to the consistency of a fine tilth.

"If the soil is full of water when ploughed the particles do not slip by each other as they would do when containing a less amount of water; hence it becomes greasy and waxy, and the particles are grained into each other, so that it may take years to bring it to its former texture. The ability of a soil to hold water depends considerably on its structure. In soils newly broken the particles are large, and they dry out very readily because of the lack of capillary action.

"It is a profitable course, therefore, after ploughing some soils to follow with a roller to firm the particles and press them together. As this treatment renews capillarity and brings supplies of moisture from the lower areas to the surface, the rolling should be followed by the harrow, which breaks the contact of the soil-pores with the open air and holds the moisture and volatile forms of nitrogen in the soil; in fact, the roller and harrow are indispensable factors in the conservation of soil-moisture in all cultivated crops of the farm. Shallow harrowing (to the depth of 3 inches) is the best practice. In cases of drought it is sometimes necessary to roll to bring the moisture to the surface, and then follow with shallow cultivation.

"It has often been noticed that a light shower helps a crop out of all proportion to the amount of rainfall. This is explained as follows:— When a soil is improperly cultivated, and a severe drought follows, the surface becomes dried out to the depth of 10 or 15 inches. The water-table sinks so low, and the surface tension is so weak, that no water is raised near the surface. When a light shower falls the water percolates into the soil. If sufficient enters to re-establish the connection of the surface and subsoil-pores, the translocation of water towards the surface naturally follows. In other words, capillarity is renewed with the immediate surface, and the soil regains its power to lift water from below. After light showers, therefore, the land should be cultivated to prevent the loss of water brought to the surface by this process of translocation."

In the lighter soils, and where the annual saltbush thrives, the areas could be very easily worked with ploughs. In the tests that have been conducted to determine the methods of laying out areas for cultivation which permit of the most economical working, it has been found that the cost of ploughing is reduced in proportion to the length of the lands. Thus, at Wagga Farm for instance, where areas laid out in 30-chain lands are ploughed for about 2s. 8d. per acre, in 60-chain lands the cost does not exceed 2s. 4d. per acre, which leaves the soil, when ploughing is done at the right time, in perfect condition for the seed-drill. Of course, ploughing under such favourable conditions as those indicated is only possible when either the plant is extensive or the area is well within control of one or two ploughs. As the soil dried out, with turn-over ploughs the furrows would be defined and the harrow would be required, but every acre that does not require the harrows means saving of time and expense.

For breaking up virgin land that is covered with dense masses of vegetable matter or a heavy growth of any kind, the rotary principle of plough works more freely and effectively, because there is nothing to get clogged, provided that the ploughman will take care to see that

the implement is properly set, and does not expect it to cope with every condition of texture of soil and amount of stubble or loose vegetable matter, without readjustment. In the turn-over ploughs, made for working in districts where the wheat lands at breaking-up time are bare, there might be a good deal of extra draught and imperfect work, through the accumulation of loose vegetable matter in great masses between the breast and beam. In ordinary wheat stubbles, as left by the reaper and binder, turn-over ploughs of two, three, or more furrows should do good work, but whether it would be as cheap as disc work in the Coonamble soils remains to be proved.

Varieties of Wheat.

In this matter nearly every farmer will find that the behaviour of any given variety is somewhat different on his holding to what it is on the areas of even his nearest neighbours. The most practical course for the newcomer to a district to adopt is to obtain from the farmer already established seed of the wheats that, on a selling basis, appear to be best, and when he has made his general sowing of this single wheat, or, perhaps, two kinds, to lay out a small strip for test of any other varieties that have gained a reputation in other districts for yield, rust-resistance, drought-resistance, rigidity of straw, high quality of grain, good milling properties, or any other feature that commends itself from a business point of view. In testing these wheats, the best plan would be to plant each variety in a row or very narrow strip with a row of the best local wheat as a check between each. Say, for instance, a wheat-grower were to obtain from the Department of Agriculture a pound or so of seed of Bobs, Lambrigg White Lammas, Farmers' Friend, Australian Talavera, Nonpareil, and Steinwedel. And say, for instance, that the local wheat which last season did best on soils similar to the one in which he is using this season was Marshall's No. 3. In laying out the experimental plots there would be first a row of Marshall's No. 3, then a row of Bobs, then a row of Marshall's No. 3, then a row of Lambrigg White Lammas, then a row of Marshall's No. 3, and so on until all the varieties for test are sown. Then around the experimental area there should be a sowing of Marshall's No. 3, so that the rows of wheat would have as nearly the same conditions as would prevail in a big field.

To do all this would not take more than a couple of days, the main thing being to have the area evenly prepared and to see that the trial varieties and the check rows have all a level chance. As the wheats progressed, their behaviour could be noted, and at harvest time it would be possible to arrive at a fair estimate of their yield and character by carefully comparing each row with the check row, thus determining whether any of the trial varieties prove superior in any respect to the check variety. In this way the farmer will be able in the course of a few seasons to hit upon varieties that can be reasonably depended upon to give reliable results in his particular soil and conditions. The Wheat Experimentalist to the Department of Agriculture, Mr. W. Farrer, has, by means of his investigations and

the breeding of new and improved varieties of wheats especially adapted to Australian conditions, made it possible for farmers throughout the State to obtain varieties that possess characteristics essential for success in all sorts of conditions of soil and climate, and farmers can obtain from the Department of Agriculture seed of those varieties for trial. It would be safe for a farmer in a comparatively new district like Coonamble to sow some of these improved wheats on a large scale right away; but, as it has been said before, every farm is governed by influences peculiar to itself, and under such circumstances it is safer, from a monetary point of view, not to let go a good thing until there is proof under the same conditions of a better.

An important advantage derived from such trials in the farmer's own areas would be definite information concerning varieties and their identity. As it is now, a farmer learns from someone that Marshall's No. 3 is a very good and reliable wheat for a certain district. When he procures some seed, the chances are he may not be able to satisfy himself that it is the variety represented, and it is quite possible for a lot of disappointment and loss to be incurred. The mere presence of un-noted experimental plots will not save a man from this sort of imposition, but if a wheat-grower takes the trouble to get from the Department of Agriculture some seed true to name, and puts the unsown balance away in a well-corked labelled bottle for future reference, and also keeps some of the resultant crop for reference, he will acquire at least sufficient knowledge of the varieties he tests to guard against flagrant imposition.

The Importance of Good Seed.

It is found in Coonamble, as in other districts, that when the conditions for planting permit of early sowing, a smaller quantity of seed is sufficient. This season as low as 16 lb. per acre is being used, but it is quite possible that in the majority of cases a heavier seeding than that will be of advantage—say 25 to 30 lb., although in the rich soils and in face of what promises to be a splendid season, the stooling may be prolific. At any rate, the bulk of seed required for sowing in this district is so small that it would be well worth while grading it, so that every grain sown may be a good one. It is not any cheaper to drill in bad or uneven grain than it is to sow the very best of seed, and from a purely business point of view it is no use raising a puny, tardy plant where there is room and food for a robust one. It is in a matter of this kind that co-operation among growers is desirable. Where it would not pay one grower to invest in proper appliances for grading seed, a number of farmers in combination could easily do so, to the great advantage of all.

Pickling Seed.

Mr. W. Farrer, Wheat Experimentalist to the Department of Agriculture, has carried out experiments for many seasons to determine the most effective means of destroying the spores of smut and bunt in wheat. Copies of his reports may be had on application to the Department.

The method of pickling adopted on a large scale at Wagga Farm—where the rainfall is about the same as in Coonamble—is a 2 per cent. solution of bluestone, the seed being immersed from five to ten minutes, the latter being allowed for plump seed.

Harrowing the Wheat Crops.

If when the crop is 6 or 8 inches high the surface should become set—not a very likely contingency in some of the Coonamble soils of spongy texture—it will pay to put light harrows over the crop to break up the crust. It takes a bit of courage and faith to do this, but the effect upon the crop is beneficial. Many a crop of wheat that has been overtaken by a dry spell following heavy rain after sowing, and is languishing in parched soil, can be brought around by this simple means.

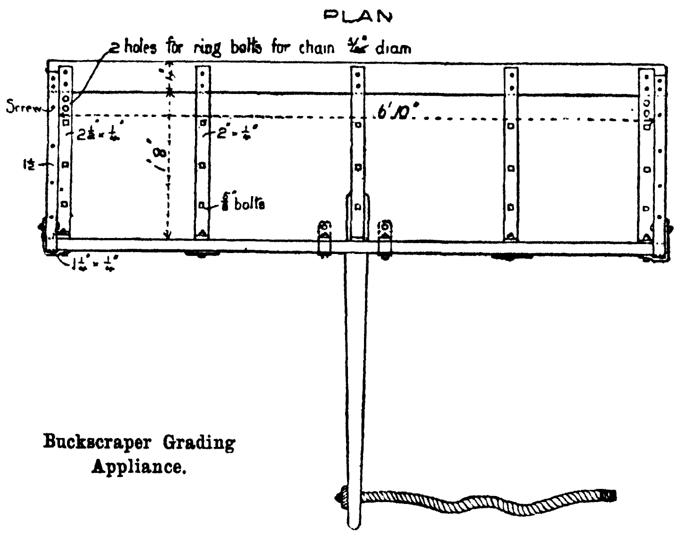
Lucerne under Irrigation.

As a standby crop for cattle and sheep lucerne is worthy of a place on every holding in such a district as this. Where there is a bore to provide cheap means of irrigation, or where water can be lifted at small expense from a stream, a plantation of an area of any extent up to a couple of hundred acres would be as safe an insurance against loss of stock in bad seasons as could possibly be devised. In establishing lucerne under irrigation in soils so friable and deep as there are to be found in the Coonamble district, the most important matter is the grading of the soil, so that when the area is flooded, the water will spread evenly over the whole surface and not lie longer in any one spot than in another. If the surface is uneven, the plants in the depressions will be drowned.

In some places it may be found possible to get a good stand of lucerne in virgin soil, but it would be far more satisfactory if the area to be devoted to lucerne could be cropped first with wheat for grain or hay. As soon as the cereal crop is harvested the land should be ploughed as roughly as possible and left to weather for a month or two. Then the harrows or scarifier should be used to destroy weeds. After the first growth of weeds is destroyed, if no rain falls, an effort might be made to get the soil saturated somehow to germinate the remaining weed seeds. When they show up, if there is a team to be spared, it will be well worth while putting the harrows or scarifier over the ground again; but this does not matter, because this second lot of weeds will most likely be destroyed in the preparation of the lucerne seed-bed.

In early autumn the soil should be thoroughly well and deeply ploughed. In the heavier classes of soils the ordinary turn-over plough should be followed in the same furrow by a subsoil plough, or an ordinary plough with the mould-board removed, so that the first 6 or 7 inches is turned over and the next 5 or 6 inches is stirred but not brought to the surface. When that is done the whole area should be carefully graded. About the best implement for this work is the one now illustrated and designed by

Mr. W. J. Allen, Fruit Expert to the Department of Agriculture, who has had a long experience of irrigation. If the area is an extensive one it should be divided off into checks



Buckscraper Grading Appliance.

of a size that the available water supply can flood in one day. For the ordinary bore-flow of Coonamble district, 5-acre checks could be thoroughly saturated in a day without monopolising the whole flow. After grading, each check—separated from its neighbour by a ridge of soil a few inches in height—should be flooded in rotation. The object of this flooding is to saturate the soil for the reception of the lucerne seed, but it also serves the purpose of revealing any irregularities in the grading. If any mounds or hollows are to be noticed, they should be worked down. When a true level is secured, and the soil has become fit, the harrows should be set to work to stir the soil into the finest possible tilth. On this the seed is sown—either broadcast or in drills; the former is generally preferred at the rate of about 15 lb. per acre. For covering the seed a brush harrow or something that will not bury them deep may be used. Lucerne sown more than an inch deep often fails to germinate. The saturation the soil has received prior to seeding will ensure even germination, and as the harrowing of the surface to prepare the seedbed will have left the soil in a state of mulch the moisture will be conserved long enough to give the young plants a good start. They are exceedingly tender during the first five or six weeks, and on no account should the area be flooded during this time. It is said by Mr. L. M. Wilcox, in his work on "Irrigation Farming," that in some of the arid districts of America the prevailing conviction is that if lucerne be artificially watered during the first six weeks of its life the plants get a setback from which they may not recover for two or three seasons. The young plants are best left to themselves until they are 9 inches to a foot high, and then they may receive a watering,

unless there is a fair fall of rain—say two or three inches during as many weeks. At this stage weeds may put in appearance, but the trouble in this respect is greatly minimised by autumn sowing and the initial work in eradication. If, however, they threaten to smother the lucerne, which during winter will be making more growth in roots than above the surface, the area should be mowed. In spring-sown lucerne crops this mowing is usually left as a mulch on the surface, but in winter it would be better to rake it up and let something eat it, or make ensilage of it. On the approach of spring, if the weather be dry, water can be applied again, and if weeds persist on showing up the area should be mowed, with the sickle-bar set rather high. The mowing will do the young lucerne, which by this time will have a vigorous root-system, a lot of good, and it will grow and stool out like fury. For the first season it should be cut as often as it comes into bud, and when the crop has become well rooted and stocky, the irrigation will resolve into one soaking of the areas in rotation after each cutting. This, in the ordinary run of seasons, is ample.

At no time should lucerne be flooded for more than twenty-four hours, and it is best, as a rule, to start the watering about 4 in the afternoon.

Care of Lucerne Paddocks.

To make more certain of permanent vigorous growth of lucerne under irrigation, the greatest care must be exercised not to water it too much. If about 100,000 gallons of water can be evenly distributed over a 5-acre plot of lucerne—and this can only be done with perfect grading and a well-arranged series of inlets from the main or head channels—the quantity will be equal to about a 1-inch rainfall. To give the plot 4 inches of water will, at that rate, take 400,000 gallons, and, allowing for a fair percentage of loss in conveyance of water, a bore which gives 1,000,000 gallons flow per day will easily provide for a very considerable area. For the first season the crop should not on any account be allowed to run to seed, and after that, not more than one crop of seed a year should be allowed to form.

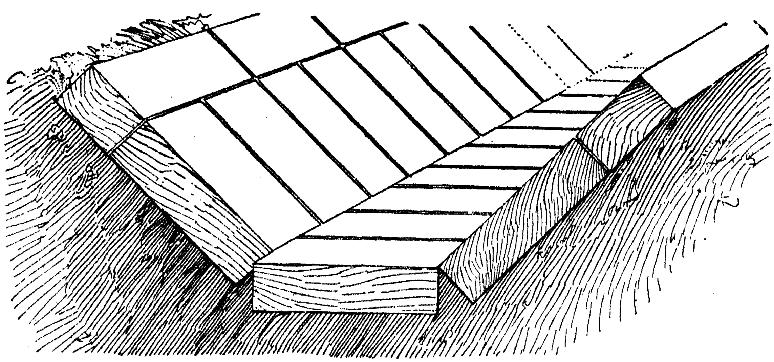
No doubt many people who go to the trouble—and it cannot be denied that a good deal is involved—of getting a good stand of lucerne may consider that the most profitable manner in which they can utilise the crops is to graze them. In that case, no matter how favourable the season may be or how well the lucerne may look, the crops produced during the first year should be mown. In the second year the paddocks may be lightly grazed, provided care be observed to remove the stock before they start to gnaw the crowns of the plants. In the third year, the paddocks will stand heavier, but still careful grazing, and under such treatment the lucerne plantations, instead of thinning out and becoming irregular in growth with a constant tendency to run to seed at a height of a foot or so, will increase in productiveness and be as good at the end of seven or eight years as at first. As already pointed out, flooding of the established crop is done immediately after mowing. This can be followed occasionally by a light harrowing to break any crust on the surface and to make the effects of the watering last longer.

Lucerne Seed.

In a good many parts of New South Wales where lucerne has been tried with and without irrigation the growth rarely attains more than a foot or 15 inches in height, and some of the plants seem to be always in bloom. In some instances it can clearly be seen that the lucerne crop is fighting for its bare life in conditions that are too rough for it. Here we find the lucerne overdosed with water run indiscriminately on to ungraded soil; there we see it languishing in soil that has never received proper preparation; and, also, it appears as the puny offspring of decadent lucerne paddocks. From some of the Hunter, Tamworth, and Mudgee lucerne paddocks the very best of strains of lucerne seed are procurable, but there is a lot of degenerated stuff on sale that is responsible for much disappointment and loss to lucerne growers. In obtaining seed great care should be observed to see that every grain is plump and healthy looking, and that it is all lucerne seed. If there appear to be any impurities, or if even a small proportion of the lucerne seeds are shrivelled, do not sow it, for the plants that come from such degenerated stuff are puny and worthless. Growers are reminded that samples of seed of any kind forwarded to the Hawkesbury Agricultural College will be tested and reported upon free of charge.

Methods of Irrigation.

In conveying water to irrigated areas from an artesian bore in country that is practically a dead level, there will be an enormous loss of water through seepage and sheer waste unless a little ingenuity be exercised in devising inexpensive channels raised to a level sufficiently high to permit of flow from the channels on to the crop. At the Howlong



A form of Channel that might be utilised where bricks could be cheaply made.

Viticultural Station of the Department of Agriculture the difficulty of conducting water for some distance across practically level and rather friable soil, in which the water flowing in furrows would soon cut channels very much deeper than the areas to be irrigated, has been overcome by the construction of a brick drain raised on a slight ridge. The drain is made of bricks, as illustrated, and is quite effective enough for the head drain of a series of lucerne checks. With a

drop, or even a dam of earth, the water could be stopped at the end of whichever check was to be watered, and the water could be let out upon the lucerne area simultaneously from several openings in the channel. If the grading is perfect, it ought not to matter where the water enters, so far as covering the whole surface is concerned, but if the water enters at one point only the plants in that portion of the

Water Gate.

Mode of applying the water.

A Water Gate, or drop in channel, and method of flooding Lucerne at Jemalong by Mr. N. A. Gatenby.

area may get too much water and those more remote not enough, whereas if the water enters the area from a number of points simultaneously there is a better chance of the paddock being evenly treated.

(*To be continued.*)

Universal Nomenclature for Wheat.

(Continued from p. 159.)

BY N. A. COBB.

Importance of Average Samples.

BEFORE entering further on an explanation of the structure of the inner endosperm and a comparison of its features in the different varieties of wheat, it seems best to delay long enough to explain briefly the methods employed.

I have previously pointed out that the biological analytical method is applicable to the other cereals, and the same is equally true of the methods now to be described, as I have here again proved by actual trial. With slight modifications they apply to rye, oats, barley, and many other graminaceous seeds. It seems to the writer hardly too much to expect that these methods will be utilised for the benefit of their pupils by teachers in agricultural and other technical schools, even where the time that can be devoted to such matters is strictly limited. The methods are extremely short and simple, require a minimum of apparatus, and yet result in giving a clear insight into the *raison d'etre* of many processes connected with the growth and marketing of cereals and their conversion into food.

In all these operations it is important to select average-sized grains in order to secure strictly comparative results. The properties of average-sized grains of one variety are to be compared with those of average-sized grains of other varieties. The selection of such average grains is much facilitated by the use of the sieves previously described in the pages of this journal. It is only necessary to refer the reader to those descriptions, which may be found in connection with the articles on "Grading of Wheat" and "Seed-Wheat."

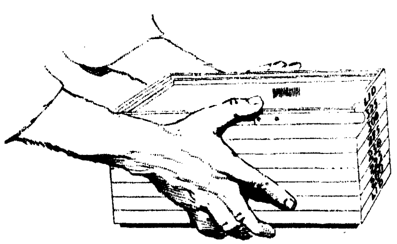


Fig. 69.—The sieves piled one on another, with the largest mesh uppermost, may be so used that each grade of seed will receive the same amount of motion. This renders the grades more strictly comparative.

Further experience has enabled me to improve the form of these sieves, as will be seen by examining the accompanying sketches. The main improvement consists in making the sieves shallower, and giving to each sieve a rebate, top and bottom, such that it may be fitted in a grain-proof manner to any other sieve of the series, or to either of the lids. These latter are also rebated top and bottom, so as to be used indifferently as the top or bottom to the series of sieves.

Each lid is furnished with an opening at one corner, through which the graded grain can be delivered into a conical pile, or run into any sort of vessel without the aid of a special funnel.

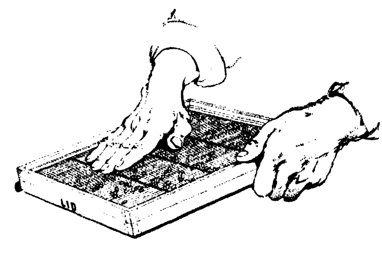


Fig. 70.—The grain, when caught, is smoothed from the inverted sieve into one of the lids.

These sieves, constructed in the manner represented, of half-round wire of about the same width as the grain it is intended to grade, are of much use in comparing various samples of wheat, and I can cordially recommend their use wherever grain is being scientifically or technically examined for any purpose whatever. The grading that can be quickly accomplished by their aid hardly ever fails to throw valuable light on the results of the examination.

Sieves constructed on this pattern are now in use in various branches of this and other Departments of Agriculture, and the experience of others, I believe, fully bears out the opinion here expressed. Among other things they are used to aid in judging competitive samples of wheat at agricultural shows, where the assistance they give is of a definite character.

To Prepare Sections of Ripe Wheat-grain.

In examining the endosperm of the various varieties of wheat, with a view to comparing them with each other, it is necessary to resort to special methods. Fortunately these methods, like the biological analysis propounded on an earlier page, are characterised by simplicity.

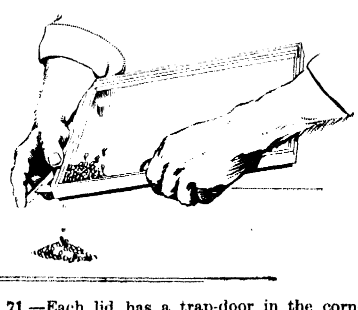


Fig. 71.—Each lid has a trap-door in the corner, through which the grain may be delivered into a conical pile or into any small receptacle.

Thin sections are required in order that the structure of the cells of the endosperm may be subjected to close scrutiny. The normal ripe wheat-grain is of somewhat the same consistency as hard paraffin, and this consistency enables one to cut sections without the tedious process of embedding. Simply clamp the grain to the microtome, trim it to the necessary form, and sections may be easily cut 5 micromillimetres in thickness, or even thinner—quite as thin as is advantageous for most purposes. If the outer skin tumbles loose it may advantageously be cemented in place by previously soaking the grain for a few minutes in a warm solution of glue or gum Arabic, to which a little glycerine has been added.

If the microtome has a clamp ill adapted to gripping the roundish wheat grain, the grain may be first glued to a block of wood.

Tangential sections, cutting the aleuron layer into several slices, may be made with no further preparation, the knife being set as for serial section cutting in parafin. It may be advantageous to trim the grain with a knife blade so as to place a front face parallel to the knife-edge.

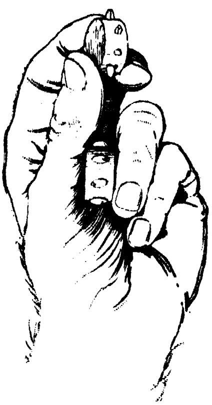


Fig. 72.—Seeds may be glued to blocks of wood if the microtome clamp will not grip them otherwise.

Sections perpendicular to the surface of the grain, are best cut by placing the grain in such a position that its outer surface is struck first by the knife-edge, and at right angles. The knife should be moved rapidly.

With the aid of a hair, or very slender sliver of wood, the sections are brushed from the knife, one at a time, into the fixing or examination fluid, which may advantageously be deposited as a drop on a slide. The sections may be fastened to the slide by the usual methods (water, or white of egg glycerine and salicylate of soda, collodion, or clove-oil mixture). If the examination is to take place at once, it is decidedly best to brush the section with the aid of a hair into a drop of the examination fluid on a slide, where it will expand instantaneously, and may be at once covered. It may sometimes be best to take the precaution to keep the cover from pressing on the section by inserting a hair or other object of the right thickness.

If it is desired to make micro-photographs of sections prepared in this manner, care must be taken to avoid the presence of stray starch grains in positions where they will obscure other details, for instance, on the surface of the aleuron layer. These troublesome bodies may be kept out of the way in the following manner:—

Prepare a clean section, dust it if necessary with a very soft and fine camel's hair brush, place it on the centre of a dry slide, and lay on a dry cover-glass. Provide the cover-glass at once with a hinge of wax,

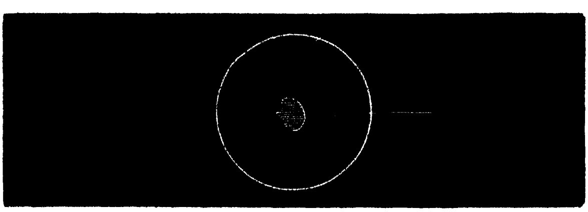


Fig. 73.—Section of wheat grain placed dry under a wax-hinged cover-glass. The liquid is to be run under always in the direction of the arrow.

as shown in the sketch. Press the cover down gently so as to flatten the section, and then run in the fixation fluid from the side of the section that presents the bran. By this method of procedure the loose starch grains are washed *away* from the bran by the advance of the fixation fluid. All the subsequent operations are performed without moving the cover-glass or injuring the hinge, the various fluids being always applied from the same side, namely, the side that presents the bran.

To Demonstrate the Distribution of Gluten in the Flour-cell.

The special method for demonstrating the distribution of the gluten in the flour-cell is also exceedingly simple. Prepare the flour-cells as previously directed—*i.e.*, by water-maceration of fragments of grain for a few hours—shake, and then place the flour-cells for a few minutes in hot water. I find it advisable to place them in water slightly warm, and then gradually bring the water to the temperature of 160 degrees Fahrenheit; or, if it is the desire to completely disorganise all the starch granules, to 170 degrees. The cells may then be examined at once, in water slightly tinged with analine colour, the demonstration of the protoplasmic net-work being fairly good, and the nucleus quite plainly rendered.

While this simple method is entirely sufficient for demonstration purposes, and has for those purposes the advantage of ease with speed, it would of course be unwise to trust it unaided by refinements if the object is a careful study of the finer histology of the flour-cell.

As an accurate series of operations, I would recommend the following:—Soak the ripe grain of wheat in water for a few hours, and then slice it into sections about 1 one-hundredth of an inch in thickness. Place these sections at once into Herman's Mixture, modelled on Flemming's stronger formula (the ingredients are osmic acid, acetic acid, and platinic chloride). After fixation, which takes place in a few hours (for rough purposes, a few minutes), wash the sections in distilled water several times, allowing them to soak a few minutes each time in a warm place. Bring the sections to 160 degrees Fahrenheit in a double boiler—such that that temperature is reached in about 15 minutes—and then shake the sections violently in a test-tube, so as to dissociate the cells. Stain in analine water safranin, of a very dilute character, having only a very faint pink tinge. Mount and examine in water. The nuclei acquire their reddish colour in the course of an hour. If the cells, before staining, be placed in picric acid the protoplasmic net-work will be stained yellow, and will show to somewhat better advantage—as the cytoplasm will then show yellow, and the karyoplasm red.

I have tried many other fixations (picric, picro-sulphuric, picro-nitric, hot water, plain osmic, osmic-acetic-chromic, various combinations of two or three of the ingredients osmic acid acetic acid chromic acid platinic chloride bi-chromates, &c., and have also tried bi-chloride of mercury. While each of these gives results having certain peculiarities, and all taken together are valuable as guarding against deception by artefacts, I do not find any of them singly to offer advantages over that described in the previous paragraph.

For the study of the finer structure of the karyoplasm, without the intervention of heat, sections of the dry ripe grain may be placed at once in fixation fluid on a slide, the cover dropped on and fixed in place, and the fluid (after a few minutes) replaced with water by drawing it under the cover with the aid of blotting-paper. The water is in turn replaced by dilute stain, which should be renewed from time to time, if it is desired to attain a maximum effect. The starch granules may be

stained with dilute iodine solution before introducing the safranin. This is an advantage, for the starch sometimes leaves an impress on the karyoplasm that closely simulates a grain of starch. Picric acid may also be introduced before the iodine. The assembled colours will then be as follows:—Outer layers of the grain red, aleuron very dark from the effects of the osmic acid, starch blue, cytoplasm yellow, karyoplasm pink or reddish. The starch granules may sometimes be advantageously tested with polarised light.

The operation of dissolving the starch may, of course, be watched on a hot stage, or by means of a projection with a solar microscope. I have, by the latter method, demonstrated the operation repeatedly with much success. One sees the flour-cell first begin to expand under the influence of the heat, then the larger outside starch granules become detached, and sometimes fall quite away. Finally the granules of starch swell to several times their normal dimensions, and become distorted and less refractive and at last disappear.

This operation once witnessed, one sees more exactly how much to allow for the alteration in structure due to the heating process.

In bringing the starch of the flour-cells into a dissolved condition, it is best, as before remarked, to apply the heat gradually, in such a manner that the whole operation is finished in the course of about 15 minutes. If the operation is too much hastened the protoplasmic net-work will be torn, and the optical figures will not be so perfect. I have seen the operation accomplished in 5 seconds, and yet the net-work left discernable, but the operation is never so satisfactory when thus hastened.

If the cells be prepared in great number, they may be heated in a test-tube placed in a beaker of cold water, which is then brought to a boil, or nearly so. It is not necessary, in order to disclose the net-work, that the starch granules should be completely disorganised; it may often be well seen in cells that have the starch only partially disorganised, and with the advantage that the net-work is less interfered with.

The removal of the cells from the test-tube to the slide is apt to rupture the net-work somewhat, but if plenty of cells are at hand good results are easily obtained.

In driving the starch out of a few cells on the slide, one may have a blank slide, with a cover-glass and drop of water of the same size as that being tested, and by keeping the blank always in a somewhat hotter position than the slide with the cells there will be little risk of overheating, as the blank acts as a warning.

Thus, if the warming be done on a heated metal plate, the blank is placed on the plate somewhat in advance, and when it boils the real preparation is removed, with the certainty that it has almost reached boiling heat. By this method a thermometric measurement may be done away with, but the results are not certain.

To collect all the Gluten from a Single Flour Cell.

If a macerated flour cell be isolated it may, as I have before said, be so manipulated as to yield up its gluten. If it is desired to mould the gluten into a single mass under the miscroscope, this may be done

The best method I have tried consists in mounting a single entire flour cell under a fairly strong cover glass, and then to clamp the slide with the right hand clip of the microscope stage. Now, taking the left hand end of the slide in the left hand, and a dissecting instrument in the right hand, one may by sliding the cover-glass move the cell about under the microscope at the same time that pressure is brought to bear on the cover glass in such a manner as to crush the flour cell. If the dissecting instrument be skilfully moved the gluten may be rolled about and accumulated into a single mass, the largest starch granules being loosened first and the smallest last. If the cell be previously stained with methyl green, so that the nucleus is made visible, one may easily see the nucleus incorporated with the gluten mass. From the first the gluten presents its characteristic properties—a tendency to cling together and a certain elasticity. These same properties are displayed when a section of the dry wheat grain is placed under a cover-glass and placed under the microscope in a dry condition, and water then run in. The gluten instantly displays its well known properties. These same properties may be seen in the unripe grain, when the gluten is moulded in some of the sap of the grain by long-continued rolling between the fingers. The gluten may be moulded together without actually breaking the skin of such a grain, *i.e.*, either an unripe grain or a soaked ripe grain. Elasticity and stickiness are common properties of protoplasm.

(*To be continued.*)

Reconstruction of Phylloxera-infected Vineyards on Phylloxera-resistant Stocks.

M. BLUNNO.

To begin this subject from the first attempt made with the American wild vines and follow it through the various changes, failures, mixed results, losses sustained by the rash or inexperienced, hopes deluded shortly after a triumph had been proclaimed, would be a task long and difficult at the same time, but would in the end give an idea of how much mistaken are those who think that when phylloxera has destroyed a vineyard, the vinegrower will just get a number of cuttings of resistant vines and start again.

Certainly, at present, the question is more simplified and on many points well fixed for the generality of cases, in which no special factors concur to make the reconstruction on phylloxera-resistant vines impossible, or at least difficult, or only partially a success.

The whole matter is so full of interesting investigations, of genial work, and shows from the beginning up to the present such steady progress, to which all European savants who take interest in viticultural subjects have contributed, that I cannot resist the seduction of, at least, making a cursory survey of it, with the principal object in view of preparing the reader who may have never heard of the subject before for what is about to follow.

The first object with which American vines were imported in Europe was to get substitutes for the European varieties, hoping to find, among the former, vines that would stand phylloxera and would bear good grapes. The idea of grafting on them followed afterwards. In their wild state, however, and with their full wild breed they would have been of relatively little assistance. America supplied the species and many of their types beside some natural hybrids; Europe, with France in the forefront, selected among them the most suitable and propagated them, also artificially created hybrids to suit special environments in which they were to live.

In California, phylloxera destroys the European vines that are cultivated there for making wine or for table grapes. Where the Californian growers had to reconstruct their vineyards on phylloxera-resistant stocks, they imported the American vines from Europe.

M. Planchon, in 1873, went to America to ascertain whether the wild vines of that continent were really resistant, and on his assurance they were imported into France. Failures occurred, as in many cases they would not grow; the reason was found afterwards to be that the nature of the soil in which the American vines had been planted in France had not been considered. Special notice should have been taken of the geological formation of the ground where these wild vines

grow in the American forests and to plant them in a similar class of soil in Europe. At that time, however, many rushed to the conclusion that the resistant vines were after all not resistant. To a certain extent the conclusion was right, in so far as some sorts then imported were not resistant enough.

In 1887, M. Viala went on a mission to that continent, and besides the description of new species he directed special attention to the nature of the soil in which they grew strongest. Thus adaptation to the ground became another necessary factor to be taken into account for the success of the American vines in Europe.

European vines were grafted on these American stocks, but having noted that the graft would take more or less well and that the grafted vines would yield more or less, and would live well or indifferently according to the varieties grafted on the same stock, or to the different stocks used for the same European variety, the question of affinity between stock on scion became a third factor of, perhaps, no less importance than the former two.

New forms issued from American species and their selection made in Europe.

The importation of cuttings and rootlings of resistant vines in Europe was very soon placed under Government control. It was necessary that it should be so, on account of the danger of spreading phylloxera into clean territories through these plants, which are most apt to carry infection. All private persons and even state viticultural institutes placed in unaffected country were forthwith debarred from importing American vines, but they were allowed to get their seeds, which as a matter of fact were distributed by the Government.

Seedlings are new individuals: these, while possessing the principal characters of the species from which they issue, show some variations of not great importance from the real botanical point of view, but that may be of consequence for a certain practical purpose.

In nature the number of new types of a certain species is ever increasing, through the seeds of the existing ones falling on the ground where many of them, if conditions are favorable, germinate and produce new individuals. Natural selection follows in the course of time. That is how a hundred distinct types of *Rupestris* in their wild state are known (*Jaeger*), and as many of *Riparia*.

What takes places in nature, men follow on their account for a certain purpose to suit the wants of civilised people. Thus, the seeds of American species of vines which the Government distributed were sown, and the new types issued were closely studied to see whether among them any were to be found, which, while having to the fullest the main characters that made their parents much sought, would have other individual qualities that would make the new types still more desirable. Thousands of such seedlings were produced; some were soon discarded, a few were preserved for closer study. I had the opportunity in my recent trip to observe several beautiful types of *Riparia* and *Rupestris* thus created at the Italian State nurseries in Sicily and at Velletri, near Rome. The new types raised at Velletri

being recent creations are still under observation, although some of them have already shown exceptional qualities, but those obtained in Sicily have already been propagated and distributed to growers with great success.

Such types are a worthy addition to those better known kinds which played a very important rôle in the early reconstruction of phylloxera vineyards, viz. :—The *Riparia Gloire de Montpellier*, the *Riparia Grand Glabre*, the *Rupestris du Lot, Martin, Metallica, Mission.*

Hybrid Vines as Stocks.

Vine-growing is pursued in such a variety of soils that the few above-mentioned sorts would hardly be expected to suit everywhere; thus originated the idea of hybridising species and cross-breeding varieties. The work done in the course of a few years for the artificial creation of hybrid and cross-bred vines is astounding. Other aims were and are in view besides increasing the number of types so as to have a larger choice for the different classes of soil. Propagation by cuttings is not easy with certain species of American vines—*Vitis Berlandieri*, to wit; neither is it easy to graft with certain species of European vines; nor is resistance to drought a quality possessed by them all. The majority of the American vines in vogue are incompatible with the presence of a certain proportion of lime carbonate in the soil; and it is well known that in Europe viticulture is the principal industry in many limestone districts; in the Charente, for instance, where the most renowned brandy is produced. Hybrids of American species were, and are, therefore, produced in the expectation that among so many thousands, a number of them may be possessed of these qualities so necessary in a plant that must be used as stock.

Millardet, Professor of the Faculty of Science at Bordeaux, was first to direct the attention to the great possibilities that hybridisation had in store. He put theory into practice, and followed his researches on a system so scientifically true that even now, when this question has so many investigators working for the same purpose, it has not been contradicted or even shown to be partially incorrect. The results achieved prove the extent of success, and, in the case under consideration, man by prying into the natural laws produced types of vines (hybrids and cross-bred vines) to suit special purposes, which types Nature, whose work is of a more general and higher order, that is, the preservation of species, has failed to do.

In the course of this report I shall name several of the types which Millardet, Couderc, De Grasset, and others, obtained by their skill and perseverance.

Hybrid Vines as Direct Bearers.

The tendency of breeders in the meantime leaned specially towards the issue of vines which would not only resist phylloxera, and in addition would possess those other perquisites above referred to, but would as well bear good grapes suitable for wine-making or for table without being grafted, and be also refractory to fungoid diseases.

Thus American species were not hybridised among themselves but with European varieties. The hybrids resulting are called Franco-American, to indicate the origin of the parents; and some are also known as *producteurs directs*, viz., direct bearers, so to refer to their faculty of yielding grapes without being previously grafted.

Thousands of attempts have been made in this direction, but unsuccessfully. A number of them have been recommended, but were soon set aside, because in every instance their grapes showed an absolute inferiority to those of the European vines, whether grafted or not grafted on phylloxera-resistant stocks. Some enthusiasts pretend that by expert vinification grapes of direct bearers could be turned to account, but even then these vines could not be depended upon, their vulnerability to phylloxera being very evident, at least in most of them. The work, however, has not been all fruitless, because some of these hybrids, although failing to produce a crop of quality that could be used for industrial purposes, have roots possessing what M. Gervais, with a happy expression, calls *la résistance pratique*—that is, they are practically phylloxera-resistant and unite with this some of those qualities which I referred to in the foregoing. The said qualities make them more suitable as stocks in many cases where *Riparia* and *Rupestris* types and all Americo-American hybrids would give a middling or an unsatisfactory result.

The Ideal Hybrid Vine.

Breeders occupied in the production of a new individual, whether animal or vegetable, well know that in the happy issue the hazard plays the principal and most important rôle. The normal hybrid shows a blend of the qualities of the parents. In it all good and bad qualities are levelled to a degree approaching a mean. Such hybrid does not suit our purpose. However, among so many normal hybrids there may be exceptions in which the parents' characters are in juxtaposition, and not fused into an average, in which, to adopt a simile, said characters are grouped like the coloured stones in a mosaic. It is the hybrid which inherits the parents' qualities and shows the possession of them integrally and separately that is sought by viticulturists.

The natural law being that in hybridisation or crossing these characters must fuse, the hybrid that is required is therefore a monster. That is why the hazard presides over the issue, and why among thousands of hybrids only a few, if any, will approach the ideal freak of nature.

M. Munson says that in his first attempt out of 75,000 hybrids only about 100 were worth keeping.

Caution is required in accepting an Europeo-American Hybrid Vine.

Caution has not often been very remarkable with breeders; some hybrids have been recommended as direct bearers or as stocks which, after a few years, have shown their vulnerability to phylloxera.

Millardet himself in perfect good faith recommended one of his hybrids as most adapted for limestone soil, viz., the *Gros Colman* x

Rupestris No. 60; but two years after he retracted, his hybrid having fallen prey to phylloxera.

At the Agricultural College of Montpellier the *Cabernet* x *Berlandieri No.* 333 was raised and highly spoken of, and, this, like many others born under the rosiest auspices, very soon fell into oblivion. I just wanted to quote these instances to show how difficult it is to correctly judge the resistance of a vine, and how even the most competent persons may be driven to mistakes when vines are alleged to be resistant before they have stood the test of some years in a soil and under a climate as similar as possible to those where these vines have to be planted. Not less than five to seven years are necessary before it is safe to commit oneself to declare phylloxera-resistant an Europeo-American hybrid. It must have stood the disease in a ground which, by its nature, is most favourable to the life and fast breeding of the insect, such as is a soil of medium texture, rather loose and not lacking moisture. To artificially infect the plant under trial is necessary so as to make sure that the subject has contracted the disease.

For hybrids, the parents of which are both Americans and typically resistant, this trial of resistance is not necessary. Adaptation to soil and affinity to the graft are instead to be considered.

Visit to Sicily.

The Sicilian climate has many points of similarity to that of New South Wales. The records of summer temperature in the plains of the interior are usually above 100 degrees F.; long spells of drought are regular every year for five or six months or more without interruption. Winters are exceedingly mild.

Before phylloxera broke out there were 715,562 acres under vines, yielding 204,683,400 gallons of wine. At present, phylloxera has more or less destroyed 475,080 acres with a fall of 146,246,152 gallons in the production of wine.

The parasite has been fought by the Government, to at least delay infection, but in a country where vineyards are so closely planted the plague was bound to overcome all efforts. Thus phylloxera is no longer fought against, and all attention is directed to the reconstruction on resistant stocks. The first attempts at replanting were much upset by the lack of knowledge as to the real resistance of American vines. Stocks that stood phylloxera in France succumbed in Sicily. The stocks *York Madeira, Jacquez, Solonis, Clinton, Vialla,* which in many parts of France are successful, have failed in that island, and have now almost totally disappeared. Of this I knew, and my aim in going to Sicily was to see what new direction had been taken in the reconstruction of vineyards after the first failures.

On 20th April I landed in Naples and met the members of the International Congress of Agriculture and Viticulture who had journeyed from Rome on their way to the island. The same evening I sailed for Palermo, where I arrived next morning.

With Professor Paulsen I visited the state vineyard of mother stocks of Luparello, where the principal resistant vines grown are the

Riparia Gloire de Montpellier and the *Grand Glabre*, the *Rupestris du Lot*, *Metallica*, *Mission*, *Riparia* x *Rupestris* 3306 and 3309 (*Couderc*), 101-14 (*Millardet*), *Berlandieri*, *Resseguier No.* 1 and 2, *Aramon* x *Rupestris Ganzin No.* 1, *Mourvedre* x *Rupestris* 1202, *Bourrison* x *Rupestris No.* 601, *Solonis* x *Riparia* 1616, *Chasselas* x *Berlandieri No.* 41 *B*.

This vineyard supplies vignerons with cuttings of resistant stocks and from here the State Nursery of Santa Flavia, a few miles east of Palermo, draws the necessary cuttings for the bench grafts which afterwards are also distributed to growers. In the year 1900, not less than 1,200,000 bench grafts had been done between the months of January and March by eighty men doing 200 grafts per day. The grafts, as soon as they are done, are planted out in the nursery without waiting for spring, as the climate there is so mild. The stock is allowed a length of 20 inches, the scion carries two eyes. In the nursery the grafts are heeled up completely; from May to July, the adventitious roots growing on the scion are cut. The point where the graft has been done is thus exposed to the air and the sun, which concur to harden it, and 35 to 40 per cent. is the proportion of those that take. The grafts on *Riparia* usually give the highest percentage of successful ones.

A very important section of the vineyard of mother stocks is laid out for experimenting the affinity of the local varieties of grapes with the resistant stocks; another section contains a number of Americo x American hybrids raised by Signor Paulsen, also many new types, principally of *Riparia*, obtained by seeds distributed by the Italian Agricultural Department, when the importation in Italy of cuttings or rootlings of phylloxera-resistant stocks was forbidden or placed under restriction.

With these stocks, raised from seeds about sixteen years ago, many vineyards in the province of Syracuse and Messina have been reconstructed, which are now growing splendidly, and in full bearing.

The *Vitis Berlandieri* is the mainstay for the reconstruction of limestone soil, but is most difficult to propagate by slips, and also some of its hybrids, although to much less extent, show the same negative character. Professor Paulsen overcomes this difficulty by planting the cuttings from October to November, that is, in full autumn, and obtained from 45 to 50 per cent of rootlings.

Not far from the State vineyard is that of a vignerons' syndicate, the object of which is to keep a large nursery for the supply to its members of resistant rooted cuttings, and of ready-grafted yearlings. The same syndicate has experimental plots in different parts of the district, with the view of trying the practical resistance to phylloxera of the different stocks, the mutual affinity with the local varieties of grapes, and to serve as an example and stimulus to the growers.

In other parts of Sicily, in Italy, in France, similar co-operative nurseries have sprung, they are encouraged, are thriving, and on the increase. The scattering of these experimental grounds all through a vine-growing country has become indispensable on account of numerous failures of stocks reputed resistant.

Distinction is now made between absolute and relative resistance to Phylloxera. It is absolute when the stock will withstand the parasite in any environment; relative when resistance becomes higher or lower on account of the circumstances under which the stock has to live. Thus a resistant vine will be more so if planted in soil eminently suitable, and less if the ground is unsuited, or if it is grafted with a variety for which it has affinity or *vice versâ*.

Environment and circumstances are so varied that it is an absolute impossibility for the State Institutions to answer and give advice on every particular instance, and besides setting the principal rules and directions for the reconstruction, they cannot be expected to do more, as they cannot experiment for everyone; thus every grower must be, to a certain extent, his own experimentalist. This statement will be borne out more prominently by what is about to follow in this report.

Resistant vines are apt to contract the disease, and numerous phylloxera are often to be seen on the roots of a resistant stock. The *Rupestris du Lot*, which is eminent for its resistance, will occasionally show the root system thoroughly infected with the parasite, so will another, viz., the *Aramon* x *Rupestris Ganzin No. 1*. Nodosities and tubercles are frequent and evident, so are lesions which are at times very deep, and the conclusion that would be drawn *a priori* on such evidences is, that these two stocks should be set aside and not employed in the reconstruction of vineyards in hot climates. In Sicily, however, the wounds caused by the insect on the roots of these two stocks are not dangerously deep; they heal up easily and leave a healthy scar. These two stocks possess, therefore, a practical resistance, and are widely employed in that Island. They have stood the test of nine or ten years.

The *Pinot* x *Rupestris 1305* dies under the morsures of phylloxera in the State vineyard of Luparello near Palermo, but it lives well at Cipolluzzo, near Modica, in the vineyard of Dr. Grimaldi. The soil of the Luparello vineyard, however, is semi-clayey and moist, and in such soils phylloxera thrives exceedingly well and is more violent in consequence, whilst the Cipolluzzo vineyard is in very dry ground.

Again the *Chasselas* x *Berlandieri 41B* shows very few phylloxera in an usually parched soil, but its roots are covered with insects in the State Nursery near Palermo and more so in that of Noto.

The luxuriant growth of a resistant stock in a certain class of soil is not always a good argument for grafting on it. A loose, deep, rich, moist soil is the typical ground for *Riparia*. *Rupestris du Lot* planted in such ground grows splendidly, but when it is grafted it continues to grow wood and leaves in preference to grapes.

Since 1892, some systematic experiments on a large scale have been undertaken in eleven vineyards, of which three belong to the State, eight to private persons. Not only the resistance of a number of species and hybrids selected or raised in France was tried under the Sicilian climate, so different from the French, but also the area of adaptation was investigated in the Sicilian soils, specially in those in which lime carbonate exists in the proportion of from 25 to 90 per cent. Many of the sorts soon failed under the virulence of phylloxera,

Fig. 1.—*Riparia gloire de Montpellier,* **growing at Howlong Viticultural Station.**

others survived. As to their adaptation to the different soils some interesting data are available.

The *Riparia Gloire de Montpellier* gives the best results in alluvial soils, fertile, deep, fairly moist, in which the proportion of lime carbonate is not over 25 per cent. (Fig. 1.)

The *Riparia Grand Glabre* adapts itself to the same soils even if somewhat drier and not so rich. (Fig. 2.)

Fig. 2.—*Riparia Grand Glabre,* **growing at Howlong Viticultural Station**

Fig. 3.—*Riparia* x *Rupestris 3306*, growing at Howlong Viticultural Station.

The *Riparia* x *Rupestris* do well in loamy soils, and tolerate a proportion not beyond 45 per cent. of lime carbonate. The *3306* (Fig. 3) is more adapted for lighter and moister soils, the *3309* (Fig. 4) for those where clay and gravel are more prevalent, and *101.14* (Fig. 5) for those in which clay is still more predominant and still more moist.

Fig. 4.—*Riparia* x *Rupestris 3309*, growing at Howlong Viticultural Station.

Fig. 5.—*Riparia* **x** *Rupestris 101.14*, **growing at Howlong Viticultural Station.**

The *Rupestris* is adapted for gravelly, stoney ground, or for poor clay soils, preferring the *R. Metallica* (Fig. 6), where the lime carbonate is not above 25 per cent., while the *R. du Lot* (Fig. 7) will not resent a proportion as high as 50 per cent. of said carbonate. This same stock answers well also in calcareous marls, or in rotten calcareous tufa, but grows indifferently or is unsuited in ground with a shallow top soil, and a compact, hard, and dry subsoil.

Fig. 6.—*Rupestris Metallica*, **growing at Howlong Viticultural Station.**

The *Aramon* x *Rupestris No. 1* (Fig. 8) is suitable in soils argillo-calcareous, dry or moist, but not cold, and with a percentage of lime carbonate not over 60.

Fig. 7.—*Rupestris du Lot*, **growing at Howlong Viticultural Station.**

The *Mourvedre* x *Rupestris 1202* (Fig. 9) is indicated for calcareous marls, moist, containing as much as 80 per cent. of carbonate of lime

Fig. 8.—*Aramon Rupestris*, **growing at Howlong Viticultural Station.**

The *Chasselas* x *Berlandieri 41 B* (Fig. 10) will do well in clay soils, but deep, rich, moist, containing lime carbonate up to 80 per cent.

Fig. 9.—*Mourvedre* x *Rupestris 1202*, growing at Howlong Viticultural Station.

The *Berlandieri Rességuier No. 1* for limestone soils, with a proportion of carbonate not above 70 per cent., the *B. No. 2* in the same soils with a percentage of carbonate not above 80.

In Sicily, like elsewhere, the *Berlandieri* has not been planted extensively, because it will not readily strike from cuttings, and for the

Fig. 10.
Chasselas x *Berlandieri 41 B*,
growing at
Howlong Viticultural Station.

little vigour they show for the first years, although it is an excellent stock, not only for its high resistance to phylloxera, but also for the great affinity it has with many local varieties of grapes, and the great crop-bearing capacity it communicates to the European vine grafted on it.

In the foregoing I mentioned that by planting the *Berlandieri* cuttings early in autumn, from 45 to 50 per cent. can be made to strike roots. It appears, however, that in certain conditions of soil this stock strikes as easily as *Riparia.*

The practice of grating the bottom joint of the cutting enhances the possibility of a greater number of slips throwing roots. This grating consists in rubbing the bottom joint on a sort of comb, made of iron spikes, so as to cause as light laceration of the bark.

However, it is generally admitted that in planting *Berlandieri*, whether cuttings or rootlings, the grower must anticipate a much larger number of *misses* than is the case with other sorts; but those stocks which finally do take will, after a few years, show a very vigorous root system.

The *Berlandieri* species was hybridised with *Riparia* and *Rupestris*, and some fine hybrids were thus raised, in which its faults are much attenuated.

The unfavourable influence of an excess of lime carbonate in a soil makes itself evident by determining *clorose* in a stock, a yellow disease which sometimes the plant succeeds in overcoming, but certain others shortly and inevitably succumb to. The different proportions of that ingredient, given as the doses which every stock can safely stand must not be taken absolutely literally. The geological formation of the soil, its chemical composition and mechanical texture, its power of retaining moisture, are all conditions which contribute to make the lime carbonate more or less readily absorbable by the roots, and in consequence more or less felt.

It is easy to understand then that where the soil is very loamy, and the lime carbonate in large nodules or lumps, and the ground dry, its influence is less felt than where the soil is fine, loose, and the lime carbonate also fine, well spread, and incorporated, with moisture never lacking. Yet there are cases quite inexplicable, such as some splendid vineyards near Pachino, in the province of Syracuse, reconstructed on *Riparia* stocks, in a soil argillo-calcareous, wet, containing 60 per cent. of lime carbonate.

How the lime carbonate exercises its influence on the stock is not well known; by using iron sulphate, applied to the soil round the vine, whether in solution or in crystals, or at the time of pruning, by daubing the fresh cuts with it, some stocks have been made to grow in soils where otherwise they would not have succeeded. Once *Berlandieri* stocks are made to grow the first years, the yellow disease is generally overcome thereafter.

The lack of affinity between stock and scion may bring about *clorose* in a vine which would have escaped it, had scion and stock agreed. Thus it is often seen that a phylloxera-resistant stock adapts itself well in a limestone soil; but as soon as it is grafted with certain varieties of European vines, the yellow disease appears—generally the forerunner of death. At the same time, the same stock in the same soil, but grafted with other European vines, thrives as if it had not been grafted at all.

The *Solonis* x *Riparia, 1616* (Fig. 11) answers well in Sicily in soil argilio-calcareous, containing from 35 to 40 per cent. of lime carbonate, fairly moist; and has shown its superiority over a number of other hybrids planted side by side which perished, either from the yellow disease or from phylloxera, such as—*Riparia* x *Rupestris, 101–15*; *Rupestris* x *Petit Bouschet*; *Chasselas* x *Rupestris, 901*; *Alicante Bouschet* x *Rupestris*, and others.

The *Riparia* x *Rupestris No. 2a*, raised at the State Viticultural Station of Palermo, is giving good account of itself. It succeeds in medium clayey soils, fairly moist, in which it grows vigorously, and if not superior is at least equal to the 3306 and 3309.

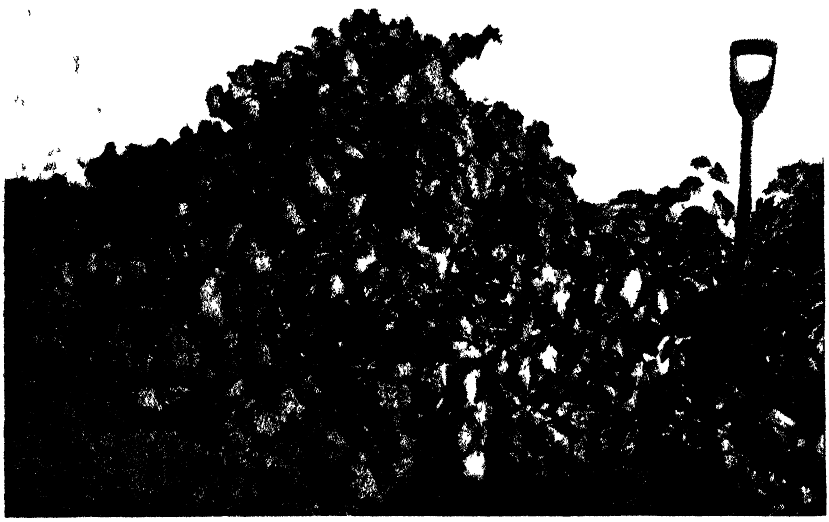


Fig. 11.—*Solonis* x *Riparia 1616*, growing at Howlong Viticultural Station.

Yet another hybrid is recommended, that is the *Riparia Cordifolia* x *Rupestris, 106–8* (Fig. 12). For several years Signor Ruggeri, of the State Viticultural Station of Milazzo, watched it closely, and now he advises to plant it. Its high resistance to phylloxera, its great affinity with the wine-grape varieties of the province of Messina, and its vigorous vegetation are the characters which it shows, principally in clayey of argillo-arenaceous soils with not more than 20 to 30 per cent. of lime carbonate. I have this same hybrid at the State Viticultural Station of Howlong, near Albury. In the first instance, about twenty stocks were laid out in a rather stiff clay soil; but on noticing its vigour I decided to extend it, and last year 400 more were planted. Next season a number of European varieties will be grafted on it to determine their affinity.

Like the two other factors, resistance to phylloxera and adaptation to soil, the third, that is, affinity between stock and scion, not being less important, had to be simultaneously tried under the different natural conditions of that country. To collect a budget of exact

information on the affinity or lack of it between the resistant stocks and the local Sicilian grape varieties, would require just as large and

Fig. 12.—*Riparia Cordifolia* **x** *Rupestris 106-8*, **growing at Howlong Viticultural Station.**

complex a plan of experimentation as that to test the suitability of the stocks to the various soils and their power of resistance to the parasite.

Fig. 13.—An area of hard, rough, clayey soil at Howlong Viticultural Station in which the *Riparia Cordifolia* **x** *Rupestris 106;* **the** *Solonis Riparia, 1616;* **the** *Mourvedre* **x** *Rupestris 1202;* **the** *Chasselas* **x** *Bealandieri 41 B* **are being tried.**

Perhaps a definition of the word "affinity" is required, in the sense in which it is used in this new branch of viticulture.

Affinity.

Affinity is the close and intimate relation existing between two subjects united by the graft, which relation is borne out by the readiness and thoroughness with which all the stocks of the same kind graft with all the scions of the same variety of European vine, not only under one set of natural circumstances, but under all conditions of soil, climate, mode of cultivation, and training. The affinity is further and principally shown by the constant and regular bearing of satisfactory crops and the longevity of the grafted vines.

Close and intimate relation between two plants, such as reflect their attitude to graft together, is not unlimited; on the contrary, is narrowed down to the bounds of botanical classification. Two plants are apt to graft together if they belong to the same botanical genus. Yet this is not necessarily so, because two plants of the same genus, or even of the same species, may sometimes show an absolute incompatibility to weld and wed together. Between the maximum affinity shown by a vine when it is self-grafted, and the absolute lack of it existing between certain vines of different varieties or species, there are intermediate degrees of affinity.

It is safe to say that affinity depends on the relationship existing in the protoplasm of stock and scion; but such relationship science is unable, at present, to determine *a priori*, thence the necessity of proceeding by the longer way of experiments to find it out.

The experiments on affinity made in other parts of Europe were of no use in Sicily, where they grow a number of varieties particular to that island. I shall not make reference in detail to the results of such experiments carried on in that extensive area, as they would have but a relative interest in Australia, where, so far as I am aware, no Sicilian grape varieties are grown; but I found it important to mention the matter of affinity objectively and connect the question with a similar one that obtains already in Australia in those districts where the reconstruction of vineyards is in progress.

Here we have a number of table-grape varieties, of which some have been locally raised, while others are very little grown outside this continent, and, therefore, the attention of the European experimentalist has not been, and is not, centred on them. For these varieties there are no data about their affinity with the various phylloxera-resistant stocks; it is necessary, therefore, that for those varieties for which no information from Europe is available, local experiments must be made.

The same may be said of a smaller number of wine-grape varieties grown in our continent.

At the State Viticultural Station of Howlong, there are some fairly large and comprehensive experimental plots; but no sensible person may expect a complete collection, which would almost mean a multiplication of experimental plots *ad infinitum*.

I caution vignerons who are about, or are already, experimenting the affinity of the varieties of their choice with the stocks suitable to their soil that the readiness and thoroughness of the graft and its vigorous

growth, although fairly indicative of affinity, are not always sure signs of it. The faculty of bearing constantly and regularly satisfactory crops for many years is the real affinity. Often, for instance, a variety of grapes grafted on resistant stocks bears rather small crops during the first years which, however, go on increasing until a certain high standard is reached and maintained for many years. In other cases crops are very large at the outset, but fall off as the years go by.

Furthermore, a number of varieties grafted on resistant stocks grow apparently luxuriantly with a splendid show of blossoms, of which relatively few will set.

The above considerations of the three principal questions, viz., resistance of the stocks to phylloxera, their adaptation to the various soils, and the affinity that must exist between them and the European vines, show that these three factors are connected, and none of them can be left untried in studying the complex problem.

It naturally follows that a stock of mediocre resistance must be planted in a ground in which it is apt to grow vigorously, also that in a bad soil any resistant stock must be grafted with the European variety or varieties of vines for which they have the highest affinity. Want of affinity not only is the cause of poor yield but weakens the stock, makes it more liable to feel the bad effects of a bad soil, and more sensitive to the attacks of phylloxera.

The actual operation of grafting is undoubtedly a check, although temporary, of the vigour of the stock. If this be planted in an unsuitable soil and, worse still, if phylloxera has already a hold of its roots, the newly-grafted stock will linger for a time. It may finally overcome this state of weakness, or it may live but poorly for years, or die of a sudden. In such cases as these it is advisable to graft the stocks in nursery and form the vineyard with ready grafted yearlings, selecting the soundest, that is to say, those which show a complete knitting of the tissues of the stock and of the scion.

The common occurrence of vines dying suddenly in full summer or, at least, losing all leaves and causing the crop to wither, and, perhaps, starting into growth again the year following, is called *folletage* by experts. This trouble occurs more or less frequently with grafted vines.

Milazzo, in the province of Messina, is a very important viticultural centre, one of the principal sea ports from which many millions of gallons of wine have been shipped to France when a Franco-Italian treaty of commerce existed. Phylloxera in this province has already caused extensive losses, which vignerons are now avoiding by replanting on resistant stocks. A very important State Viticultural Station is doing a great deal of work and leading the local vine-growers in the great work. A large vineyard of mother plants for the production of cuttings, and a nursery of 20 acres for raising rootlings, grafted and ungrafted, for distribution among private growers, are admirably kept, while experiments engage at the same time the attention of the director and assistants.

Phylloxera of the Leaves.

At the time of my visit, on the 28th of April, I found that labourers were busy in checking the further spread of the gall producing phylloxera on the young leaves.

It is well known that on European vines phylloxera has never attacked the leaves, and but a few exceptional instances have been recorded of phylloxera galls on such leaves; on the contrary, some resistant stocks are very liable to this form of infection which eventually may take such proportion as to check the growth of the resistant stock.

In 1901, Signor Ruggeri informed me that many mother plants, especially those of the *Rupestris du Lot* variety, had suffered badly through the numerous phylloxera galls on the leaves, to the extent that the production of cuttings was greatly reduced. At the time of my visit the *Phylloxera gallicole* had just made its reappearance on the young shoots. Experience has shown that by collecting the young affected leaves at that stage and by destroying them, the prolificacy of the leaf phylloxera, which is by far much larger than that of the root insect, could be checked to a great extent.

Two very important private nurseries owned by Signor Zirilli I also visited, where I saw over a million of stocks which had been grafted at the bench. Here I could not but admire a splendid plot of 500,000 *Rupestris du Lot* on which the variety *Cataratto bianco* had been used as scion; their vigour, their healthiness, reflected much credit on the establishment. Signor Zirilli is at the same time extending his plantations with the *Aramon* x *Rupestris No. 1,* for which there is now a great demand in many districts in Sicily. While on my visit to this place I witnessed a business controversy between this gentleman and a foreign nurseryman, who had supplied the former with many thousand cuttings of the *Aramon* x *Rupestris No. 1.* It appears that these cuttings, when they came into leaves, showed a great percentage of the *Aramon* x *Rupestris No. 2,* which experience has shown to be inferior to the *No. 1* for vigour and for the lack of affinity with the variety of grapes grown in Sicily.

Three miles outside the city of Messina, near the village of Annunziata, there is another State Viticultural Station, which distributes no stocks, but has a purely experimental character. The soil is rich in lime carbonate, and besides the *Rupestris du Lot,* and the best *Rupestris* hybrids adapted to such soil, several types of *Berlandieri* and hybrids of this species are grown, most of them grafted several years ago and now in full bearing.

Here I saw the splendid results obtained by grafting on green, that is, by placing a green scion on a green shoot of a phylloxera-resistant stock at a suitable time towards the end of spring. I shall deal later, in a separate article, with the two methods of green grafts as are in vogue in Sicily with many growers.

From Messina I went to Riposto, in the province of Catania. In the former town there is a State Oenologic Station, the principal scope of which is to carry on experiments of vinification and improving on the

methods of wine-making as adopted locally. Interesting work has already been done by my college mate, Signor Ricciardelli, of which I shall write in the second part of this report, as I prefer to deal with the various subjects separately rather than to follow my itinerary in giving the account of what I have seen in my travels.

I would gladly have visited the Royal College of Viticulture of Catania, the State Viticultural and Oenological Station of Noto, and the vineyard of mother stocks and nursery owned by the eminent viticulturist, Dr. Grimaldi, at Modica, but the limited time, compared to the vast programme of visits which I intended to make in other countries, compelled me to return to Italy. However, during my sojourn in Europe, I kept active correspondence with the heads of the establishments which I could not visit, and thus collected much information by letters and from recent publications. I deem it beyond the scope of this report to refer to their contents, as I consider it more convenient to narrow down this paper, for clearness and brevity's sake, to what I actually saw.

I left Sicily after a tour that lasted a fortnight, and although highly pleased with the amount of experimental work already done there, preparatory to the reconstruction of vineyards on resistant stocks, and pleased also with the actual reconstruction as far as carried at present, even now I cannot dispel the sad impression left on me by the general havoc that phylloxera has caused in a few years.

Hawkesbury Agricultural College and Experimental Farm.

The Pig Industry.

H. W. POTTS.

I.

To treat in any adequate manner such a subject as pig-raising will demand a series of articles which it is proposed subsequently to issue in pamphlet form. The subject of profitable pork raising is becoming more interesting, seeing that it is intimately associated with the development of agriculture and dairy farming throughout the State. It is surprising why so many farmers neglect to keep pigs. Breeding sows are so cheaply provided for. They cost less than any form of stock until they approach the farrowing period. The capital required to add pig-raising to the general routine of farming enterprise is comparatively small. With judicious management the pig makes better and quicker returns than any other class of domestic animal, more especially under the favourable conditions provided by a warm climate, where sunshine and health are invariable accompaniments, and where grazing is plentiful. For the year ending 1901, 11,089,891 lb. of bacon and ham was produced in New South Wales. The following year a marked falling off was experienced owing to the prevalence of drought. The output for 1902 was 8,995,856 lb., or a decrease of nearly 19 per cent. During that year 169,666 lb. of bacon and ham produced in the State, and valued at £6,173, was exported, chiefly to Western Australia, New Caledonia, and New Guinea. In addition to this, 510,160 lb. of frozen pork, valued at £11,399, was exported, the bulk of which went to South Africa.

The most significant feature, however, and one which ought to be distinctly emphasised, was the excess in value of imports over exports in such products during 1902. These were 1,962,157 lb. of bacon and hams and 178,080 lb. of frozen pork, valued at £77,358—the net imports being £59,786. Despite the discouraging effects of the drought in 1902, it is to be noted that an increase has taken place in the establishment of factories solely for the curing of bacon and hams from seven in 1898 to eighteen in 1902: further, three butter factories combine bacon-curing with butter-making, and one with the manufacture of cheese.

Not only in the Commonwealth but throughout the world there is observed an almost incredible increase in the consumption of bacon,

ham, small pork, and other classes of food derived from the pig. No domestic animal provides us with a more useful, varied, and tasteful assortment of edible delicacies.

There exists an unlimited and expanding market for bacon, ham, and pork in Great Britain. In that country about 250,000 tons of bacon are annually imported. The total purchases, including pork, lard, and other pig products, exceed a money value of £26,000,000. Ten years ago England's bill for this class of food was less than one-half of that sum.

The principal suppliers are Denmark and Canada. In the former country pork raising has advanced in importance with dairying. The Danes have extended their splendid co-operative system to include bacon-curing.

We have fully established the dairying industry on sound co-operative principles here, and it seems an easy task to encourage the growth of pigs on lines that must certainly realise satisfactory profits.

In Australia we may divide those engaged in pig-raising into five classes:—

1. The stock-owner, who rears pigs on a large scale, and in which grazing forms the main source of food supplies.
2. The dairy farmer, who supplies milk for separation at the creameries and factories, and who utilises the skim milk for pig-feed.
3. The agriculturist, who systematically grows food for pigs—such as cereals, maize, clover, lucerne, peas, rape, potatoes, pumpkins, &c.
4. The suburban pig raiser and fattener, who purchases the by-products from breweries, distilleries, canning, biscuit, and other factories, flour mills, copra mills, abattoirs, hotels, public institutions, &c.
5. The householder, who rears a limited number of pigs in styes, to eat up the waste from the table of the home.

There is an unlimited market in the form of an export trade to London alone, but how many unexplored centres of trade yet remain to be exploited with an article of food which can be so profitably raised, cured and shipped with so little risk? There are many points to be realised by our pig-breeders, to place them in a position to take up this industry with a prospect of success. Prejudices have, in many instances, to be overcome. The slipshod treatment, the unpardonable indifference and neglect to which the best of our domestic animals are subjected, demands our constant reprobation. The correct lines are not understood. Numbers of our producers consider the pig a filthy, stupid, greedy, lazy animal, yet the filthy habit in most instances is induced by the neglect of the owner. A well-bred pig is as easy-tempered, intelligent, and as docile as a dairy cow. As for the animal's greedy propensities that is a characteristic to be fully encouraged in order to realise the greater returns for pork.

In the avocation of pig-raising, breeding is the bedrock of success irrespective of type. It is clearer now than ever it was that if pigs are worth keeping at all we must pay due regard to their breeding and individual qualities. The mongrel or cross-bred sire must be rendered less conspicuous than he is at present. Pedigreed stock are now available and are steadily increasing in number and character. Their influence is wholly for good.

The breeding of pigs is equally on a level with the breeding of cattle, horses and sheep, in so far as the dominating principles are involved. Pedigreed sires, in every instance, are essential factors in impressing any herd of pigs with symmetry, vigour, early maturing, and other lucrative qualifications. It is generally considered by breeders that the sire determines the outward form and structure of the progeny, including legs, quality, and fancy points, whilst the sow supplies the frame and internal organisation, such as the digestive functions, breeding qualities and fattening propensity.

The distinctive features of profitable meat production, and the intrinsic qualities to be recognised in special breeds of pigs, are a large amount of succulent, tender meat with good texture, strong bones, light offal, prolificness, early maturity, a good back, all-round development of fore and hind quarters, clean in habit, a greedy feeder, sound healthy organisation, good handling qualities, a smooth, scurfless skin, with bright, clean, and flexible hair, and a disposition to resist disease.

Unless pigs are well cared for, suitably handled, properly fed and improved strains of blood constantly introduced, they rapidly deteriorate and revert to the original style of the old pig. It would serve no useful purpose in these articles to attempt the history of the pig from the earliest crosses of the Chinese with the Neapolitan breeds in producing our present types, further than to state that the aboriginal breeds of Great Britain have been of service in introducing hardiness, constitutional vigour and prolificness, and the Chinese varieties, fineness of form, a docile disposition, aptitude to fatten, and delicacy of flesh.

The great charm of the pig's use on the farm, in the dairy, the orchard, the garden, is its indispensable character in utilising a quantity of farm and other produce which is practically unmarketable, and would otherwise be wasted. Again, these animals are of great service in the establishment of a rotation of crops to fertilise the soil.

Apart from their service as scavengers, it is questionable if any domestic animal will give a quicker or more certain profit for systematic feeding and intelligent treatment. The animal deserves careful study, with keen attention to breeding, selection, and feeding.

We have had sufficient experience to indicate which of the modern breeds are most suitable to raise under Australian conditions:—

Black—Berkshire, Long Black, and Poland China.

White—Large, Middle, and Small Yorkshire.

Red—Tamworth.

With one exception, these are British breeds of pigs, and they are unquestionably superior to those of other countries, and are the best

amongst the British types. The founders of these types in each instance have aimed at developing one marked characteristic in early maturing. This has been accompanied by an improvement in quality of flesh. In securing these desirable points, size has been sacrificed. Much care has to be exercised in avoiding inbreeding, seeing it provokes a tendency to curtail fecundity and lessen robustness. A farmer has to select the breed of pig he requires, and in doing so he is guided by the surrounding conditions of food, housing, and the class of trade he purposes to cater for. For instance, if a long distance from market, he may be compelled to grow pigs to be converted into bacon. In some cases, one class of pig is more popular with the consumer than another. The market demands are paramount in the growth of any article of food. The class of bacon most saleable must be considered. Tastes change in this as in other classes of food. In our warm climate, heavy fat sides of bacon are out of favour. A small side of delicately flavoured meat, plentifully streaked with lean, is sought for. The Tamworth is capable of producing bacon of the best quality, and crossed with the Berkshire pays well. For general-purpose pigs, in which the profitable production of either bacon or pork, or both, is aimed at, the middle York and Berkshire breeds offer all the qualifications demanded. One consideration is of considerable importance in determining the qualifications of a breed for this country, and that is the facility with which they adapt themselves to their new environment and conditions. The Berkshire, Long Blacks, and Tamworths have acclimatised admirably, and evidently have suffered no inconvenience or deteriorated in any useful point.

For successful pig-farming, any district will do provided there is a supply of good soil on which feed can be grown, a fair amount of shade provided, and an ample water supply.

With the knowledge that swine fever has appeared in this country, it is well to point out that water forms a favourable means of spreading infection.

A good spring or a small running creek, uncontaminated by drainage, will provide the most suitable supply. The banks of a river are objectionable, as pathogenic or disease-producing organisms, such as those responsible for anthrax and swine fever, are conveyed long distances by water.

Shallow stagnant lagoons, billabongs, and dams are objectionable, and become putrid in time. It is better to provide troughs that can be frequently emptied and cleansed.

In the hot weather all pigs should have water available as well as shelter under trees or sheds. The hard compact skin of the pig is unfavourable to free perspiration, hence cool situations and plenty of water to wallow in during the height of summer is always advantageous.

(*To be continued.*)

FIELD EXPERIMENTS WITH POTATOES, SPRING 1903.

GEO. L. SUTTON,
Experimentalist, Hawkesbury Agricultural College.

ON soil generally regarded as suitable for potatoes the past season has been especially favourable for their growth. With the exception of a slight check experienced early in December their growth was continuous, due to the showery weather which was prevalent almost from planting time to maturity.

The trials commenced last season were repeated by planting the following experiments :—

I. Planting the sets at different depths.

II. A comparative trial of varieties.

III. Fertilizer trials.

Experiments I and II.

These experiments were planted in the same acre block. The soil was a fair quality pipeclay loam. Its condition had been improved by

Students assisting in Potato Planting Experiments Hawkesbury Agricultural College.

the treatment given it. In October, 1902, cowpeas were planted and fed off by pigs; in February, 1903, barley was sown, and in June this was

grazed off by sheep. In August the stubble was ploughed in and the ground thoroughly prepared for the potatoes, which were planted during the second week in September.

The block was situated on a slight ridge. The liberal rainfall during September and the early part of October, however, saturated the ground and flooded some parts of it. This happened just as the plants were coming above the ground. The "come-up" was consequently uneven and irregular, and to such an extent that the experiments were spoilt. No information whatever could be obtained from Experiment I.

Whilst digging the produce from the plants which grew in Experiment II, care was taken to observe which varieties seemed more suitable for our conditions than others. Fifty-one varieties were growing. Of these "Brownell's Beauty" stands first as regards quality and freedom from disease. It is, however, followed closely by a potato received here under the names "Adirondack" and "Satisfaction." This variety is slightly earlier than "Brownell's Beauty," and on our soil is a much heavier yielder.

Other varieties, which for this district seemed more suitable than the average are:—"Early Ruby," "Bliss' Triumph," "Early Rose," "Lord Tennyson," "Extra Early Vermont," "Carman No. 1," "Burpee's Extra Early," "Reading Russet," "Herd Laddie," "Avoca," "Breese's Prolific," "Beauty of Hebron," "Up to-date," "Queen of the Valley," and "Manhattan."

Owing to the flooding which the plot received, the imported varieties did not again receive a fair trial; very little information regarding their merits was obtained. "Sutton's Reading Russet," "Sutton's Windsor Castle," and "Sutton's Early Regent" are the most promising.

Experiment III.

This experiment was divided into the following sections:—

A. An experiment to determine the need of the crop for a fertilizer containing one, two, or three elements of plant food.

B. An experiment to determine the most suitable source of nitrogen for this crop.

C. An experiment to determine the most suitable source of phosphoric acid for this crop.

D. An experiment to study the effect of top dressing the crop.

This experiment required fifty-two plots, and occupied the whole of one of the acre blocks. Each plot consisted of four drills which were 25 yards long and 2½ feet apart. This was an alteration in the form of the plot adopted last year, when each plot consisted of a single drill

running the whole length of the block. It was thought that the results obtained last year were, to some extent, affected by diffusion of the fertilizers from one drill to another. In order to overcome this objection, an alteration in the form of the plots was made, and only the produce of the centre (1 chain) of the two inner drills used for comparison.

In order to minimise the variations due to the unevenness of the soil, each plot treated with fertilizer had adjacent to it a plot to which no fertilizer had been applied. By comparing the results obtained from these two contiguous plots, any benefit due to the use of a fertilizer becomes apparent.

The soil on the block selected was not even, but most of it consisted of a free chocolate loam, the best class of soil we have on the College.

The previous treatment of this block was as follows:—In March, 1899, it was sown down to prairie grass (*Bromus unioloides*), and the following fertilizer applied:—bone-dust, 1 cwt.; superphosphate, 1 cwt.; guano, 1 cwt.; and sulphate of potash, ¼ cwt. The following spring the crop, a good one, was removed for hay; from that time until March, 1903, the block was used for grazing. In March, 1903, it was ploughed up and sown with oats, which in July were eaten off by sheep. During August, the stubble was ploughed in and the ground thoroughly prepared for the potatoes.

The soil was in good mechanical condition and well stocked with humus. The whole block was marked out in drills 2½ feet apart which ran lengthwise of the block. Transverse lines were then marked so as to divide the block into four sections with pathways, 10 feet wide, between each. The sections were known respectively as A, B, C, D. Each section had in it fifty-two drills or thirteen plots, each plot consisting of four drills.

Each lot of fertiliser, after being weighed and mixed, was evenly distributed, and thoroughly mixed with the soil, in the drills on the plot set apart for it, by means of the Farmer's Friend fertiliser drill, in the manner adopted last year and described in this *Gazette*, April, 1903.

The variety of potato used was "Brownell's Beauty," the seed of which had been grown here during the previous autumn. The sets, cut as uniformly as possible, were planted at the bottom of the furrows, 6 inches deep, and were lightly covered with soil by a smoothing harrow. The furrows were subsequently filled in by the after-cultivation given the crop. The plants were not hilled.

The crop was planted during the first week in September, and harvested during the last week in January.

Section A.—An experiment to determine whether the crop requires a fertiliser containing nitrogen, phosphoric acid, or potash, or a combination of two or three of these elements of plant-food.

The results obtained are as follow :—

Plot No.	Drill No.	Fertiliser used.	Yield per portion of plot weighed.		Yield per Acre.		Plants missing in row weighed.
			Large	Small	Marketable.	Gross.	
			lb.	lb.	t. c. q. lb.	t. c. q. lb.	
A 1	2 and 3	Unmanured	36	11	2 2 1 20	2 15 1 16	10
A 2	6 „ 7	Sulphate of ammonia (120 lb. per acre)	60	12	3 10 2 24	4 4 3 12	9
A 3	10 „ 11	Superphosphate (320 lb. per acre) ...	62	16	3 13 0 8	4 11 3 20	9
A 4	14 „ 15	Unmanured	64	18	3 15 1 20	4 16 2 16	20
A 5	18 „ 19	Sulphate of potash, 160 lb. per acre ...	50	9	2 18 3 20	3 9 2 4	20
A 6	22 „ 23	Sulphate of ammonia 120 lb. ; superphosphate, 329 lb. per acre	81	10	4 15 1 24	5 7 2 0	14
A 7	26 „ 27	Unmanured	79	11	4 13 0 12	5 6 0 8	2
A 8	30 „ 31	Sulphate of ammonia, 120 lb. : sulphate of potash, 160 lb. per acre.	78	9	4 11 3 20	5 2 2 4	6
A 9	34 „ 35	Superphosphate, 320 lb. ; sulphate of potash, 160 lb. per acre	98	10	5 15 2 0	6 7 1 4	2
A 10	38 „ 39	Unmanured	90	11	5 6 0 8	5 19 0 4	1
A 11	42 „ 43	Sulphate of ammonia, 120 lb. : superphosphate, 320 lb. ; sulphate of potash, 160 lb. per acre	83	16	4 17 3 8	5 16 2 20	3

Section B.—An experiment to determine the most suitable source of nitrogen to use, and also whether a mixture of a soluble and an insoluble source of nitrogen is preferable to either forms applied alone. The actual amount of nitrogen applied to each plot is approximately the same. A plentiful supply of phosphoric acid—superphosphate, 320 lb. per acre, and potash, sulphate of potash, 160 lb. per acre—was applied to each plot so as to ensure that the yield would not be affected by a shortage of these elements of plant-food.

The results obtained are as follow :—

Plot No.	Drill No.	Nitrogen how supplied.	Yield per portion of plot weighed.		Yield per Acre.		Misses.
			Large	Small	Marketable.	Gross.	
			lb.	lb.	t. c. q. lb.	t. c. q. lb.	
A 10	38 and 39	Unmanured	90	11	5 6 0 8	5 19 0 4	1
A 11	42 „ 43	Entirely by sulphate of ammonia (120 lb. per acre)	83	16	4 17 3 8	5 16 2 20	3
A 12	46 „ 47	Entirely by nitrate of soda (160 lb. per acre)	91	18	5 7 1 0	6 8 1 24	2
A 13	50 „ 51	Unmanured	95	8	5 11 3 24	6 1 1 16	3
B 1	2 „ 3	Unmanured	67	15	3 18 3 24	4 16 2 16	11
B 2	6 „ 7	Entirely by blood (200 lb. per acre) ...	78	20	4 11 3 20	5 15 2 0	—
B 3	10 „ 11	{ $\frac{1}{3}$ of the amount by blood (insoluble), 66 lb. per acre ... ... $\frac{2}{3}$ of the amount by sulphate of ammonia (soluble), 80 lb. per acre }	102	16	6 0 0 24	6 19 0 8	—
B 4	14 „ 15	Unmanured	94	11	5 10 3 4	6 3 3 0	2
B 5	18 „ 19	{ $\frac{2}{3}$ of the amount by blood (insoluble), 133 lb. per acre ... ... $\frac{1}{3}$ of the amount by sulphate of ammonia (soluble), 40 lb. per acre }	82	10	4 16 2 16	5 8 1 20	2

Section C.—An experiment to determine the most suitable source of phosphoric acid to use for this crop. In the case of the insoluble

sources of phosphoric acid also to determine whether it is more beneficial to use a mixture of superphosphate with the insoluble sources than to apply them alone. The actual amount of phosphoric acid applied to each plot under trial was approximately the same. A plentiful supply of nitrogen—sulphate of ammonia, 120 lb. per acre—and potash, sulphate of potash, 160 lb. per acre, was applied to each plot so as to ensure that the yields would not be affected by a shortage of these elements of plant-food. When necessary the amount of superphosphate was supplemented by the addition of an amount of blood sufficient to equalise the amount of organic nitrogen supplied by bonedust, digestor refuse or bone char.

The results are as follow :—

Plot No.	Drill No.	Phosphoric acid : how supplied,	Yield per portion of plot weighed.		Yield per Acre.		Misses.
			Large	Small	Marketable	Gross.	
					t. c. q. lb.	t. c. q. lb.	
A 10	38 and 39	Unmanured	90	11	5 6 0 8	5 19 0 4	1
A 11	42 ,, 43	Entirely by superphosphate (320 lb. per acre).	83	16	4 17 3 8	5 16 2 20	3
B 6	22 ,, 23	Entirely by Thomas' phosphate (320 lb. per acre).	86	13	5 1 1 12	5 16 2 20	1
B 7	26 ,, 27	Unmanured	80	13	4 14 1 4	5 9 2 12	3
B 8	30 ,, 31	Entirely by digestor refuse (320 lb. per acre)	87	12	5 2 2 4	5 16 2 20	4
B 9	34 ,, 35	Entirely by superphosphate (320 lb. per acre)	106	15	6 4 3 20	7 2 2 12	4
B 10	38 ,, 39	Unmanured	105	10	6 3 3 0	6 15 2 4	2
B 11	42 ,, 43	⅔ by superphosphate (213 lb. per acre) ⅓ by digestor refuse (107 lb. per acre)	100	17	5 17 3 12	6 17 3 16	6
B 12	46 ,, 47	⅓ by superphosphate (107 lb. per acre) ⅔ by digestor refuse (213 lb. per acre)	102	10	6 0 0 24	6 12 0 0	2
B 13	50 ,, 51	Unmanured	95	10	5 11 3 24	6 3 3 0	3
C 1	2 ,, 3	Unmanured	83	11	4 17 3 8	5 10 3 4	7
C 2	6 ,, 7	Entirely by superphosphate (320 lb. per acre)	93	16	5 9 2 12	6 8 1 24	5
C 3	10 ,, 11	Entirely by bonedust (218 lb. per acre)	102	12	6 12 0 0	7 6 0 16	3
C 4	14 ,, 15	Unmanured	102	9	6 12 0 0	7 2 2 12	5
C 5	18 ,, 79	⅔ by superphosphate (213 lb. per acre) ⅓ by bonedust (72⅔ lb. per acre)	115	10	6 15 2 4	7 7 1 8	...
C 6	22 ,, 23	⅓ by superphosphate (107 lb. per acre) ⅔ by bonedust (145 lb. per acre)	107	7	6 6 0 12	6 14 1 12	3
C 7	26 ,, 27	Unmanured	91	10	5 7 1 0	5 19 0 4	4
C 8	30 ,, 31	Entirely by bone char (180 lb. per acre)	99	13	5 16 2 20	6 12 0 0	...
C 9	34 ,, 35	Entirely by superphosphate (320 lb. per acre)	111	13	6 10 3 8	7 6 0 16	5
C 10	38 ,, 39	Unmanured	103	14	6 1 1 16	6 17 3 16	2
C 11	42 ,, 43	⅔ by superphosphate (213 lb. per acre) ⅓ by bone char (60 lb. per acre)	97	15	5 14 1 8	6 12 0 0	6
C 12	46 ,, 47	⅓ by superphosphate (107 lb. per acre) ⅔ by bone char (120 lb. per acre)	96	12	5 13 0 16	6 7 1 4	1
C 13	50 ,, 51	Unmanured	100	11	5 17 3 12	6 10 3 8	1

Section D.—An experiment to determine the effect of top-dressing the potato crop. The fertiliser used in this experiment was a mixture containing—nitrogen, 4 per cent.; phosphoric acid, 8 per cent.; and potash, 10 per cent. It was made up as follows:—Nitrate of soda, 8 lb.; blood, 25 lb.; superphosphate, 47 lb.; and sulphate of potash, 20 lb. The top-dressing was applied on 24 November, 1903, when the plants were 12 to 15 inches high. Rain fell a few days after the top-dressing.

The results obtained are as follow :-

Plot No.	Drill No.	Amount of Fertiliser.			Yield per portion of plot weighed.		Yield per Acre.		Misses.
		Applied at Planting.	Used for Top-dressing.	Total.	Large.	Small.	Marketable.	Gross.	
		lb. per acre.	lb. per acre.	lb. per acre.	lb.	lb.	t. c. q. lb.	t. c. q. lb.	
D 1	2 and 3	......	......	......	50	13	2 18 3 20	3 14 2 0	32
D 2	6 ,, 7	250	......	250	97	15	5 14 1 8	6 12 0 0	7
D 3	10 ,, 11	500	......	500	99	13	5 16 2 20	6 12 0 0	3
D 4	14 ,, 15	......	......	......	113	6	6 13 0 20	7 0 1 0	3
D 5	18 ,, 19	750	......	750	111	8	6 10 3 8	7 0 1 0	8
D 6	22 ,, 23	1,000	......	1,000	115	14	6 15 2 4	7 12 0 4	1
D 7	26 ,, 27	......	......	......	110	10	6 9 2 16	7 1 1 20	1
D 8	30 ,, 31	250	250	500	112	10	6 12 0 0	7 3 3 4	1
D 9	34 ,, 35	500	250	750	114	7	6 14 1 12	7 2 2 12	4
D 10	38 ,, 39	......	......	......	105	11	6 3 3 0	6 16 2 24	6
D 11	42 ,, 43	750	250	1,000	114	7	6 14 1 12	7 2 2 12	2
D 12	46 ,, 47	500	500	1,000	108	9	6 7 1 4	6 17 3 16	1
D 13	50 ,, 51	......	......	......	95	9	5 11 3 24	6 2 2 8	3

A careful study of the results will reveal the fact that the differences in the yields are probably due more to the variations in the soil than to the application of fertiliser. Apparently, the direct application of any fertiliser to the crop this season was unnecessary. It must, however, be remembered that the ground was in good condition and well stocked with humus, owing to the treatment it had received since 1899, though from that date no manure or fertiliser had been applied to the block. The season was exceptionally good and favourable for this crop, so that from this experiment we cannot assume that the potato does not require the direct application of fertilisers.

Progress Report on Germination of Cereal Seeds.

Effect on cereal seed of steeping it for bunt.—Does steeping affect the germination capacity?—Do some varieties resist the deleterious action of the fungicide more than others?

C. T. MUSSON.

In the steeping of cereal seed for bunt it has always been understood that the germs are affected, causing more or less loss, though to what extent this occurs has been doubtful.

Mr. Farrer points out: "It is difficult to make anything like accurate observations of the effect of the different fungicides on the germination of the seeds in the field; nor are the laboratory tests fully satisfactory, for there is no assurance that on seeds germinating the resulting plantlet will be enabled to attain maturity, owing to damage done to its health and vitality by the poison, or to extraneous causes, such as attack from insects, destruction by birds, or excessive moisture, and other causes operating in the same direction." Further, "the amount of injury done by treatment with any fungicide depends very much on the variety treated."

It was chiefly with the latter object in view that a series of tests was recently carried out here at the suggestion of Mr. Farrer, and in conjunction with the general field tests under Mr. Sutton,

1st. To ascertain something definite as to the loss through damage done to the germ by two selected fungicides.

2nd. To ascertain whether, under given conditions, amongst certain selected varieties, any resisted the action of the fungicide more than others.

To this end three experiments were carried out as follows :—

Experiment I.

Samples of wheat and barley (varietal names unknown) were divided into two lots and tested for vitality only, in damp blotting-paper, under exactly similar conditions with respect to treatment and surroundings; one lot without any preparation; the other dipped in sulphate of copper (1 lb. in five gallons of water) for one hour, well shaken up, the liquid then poured off and the seed covered with lime-water for an hour; this latter treatment to get rid of any remaining copper, as if any remains dissolved in the water as sulphate of copper it is liable to be absorbed by the seed and cause damage to the germ, probably the very thing that causes such damage as is generally caused by steeping in fungicides. The lime, however, combines chemically with any copper remaining, and prevents this damage by removing it from the liquid surrounding the seeds. This experiment commenced 8th October, and finished on the 15th, with the following results :—

EXPERIMENT I.

	Temp.	Treatment.	Germinated in seven days.
	°F.		Per cent.
Wheat	68	Steeped in sulphate of copper, 1 lb. in 5 gallons of water, 1 hour; lime-water, 1 hour.	70·1
Barley	68	Do do ...	34·59
Wheat	68	Not steeped...	9.715
Barley	68	Do	70·0

This clearly shows that steeping damages the seed by preventing germination, doubtless through damage to the germ; at any rate many failed to germinate.

The next step was to trace out what becomes of the seeds which fail to germinate quickly.

Experiment II.

Seeds, all wheat, were steeped in sulphate of copper, and afterwards lime-water, as in Experiment I. The test commenced 27th September. By the fifth day germination proper had ceased; two days later, however, there commenced a spurious form of germination, the plumule being pushed out, covered by its sheath, with no sign of rootlets. In some few cases, two days later a few roots began to appear, mostly the secondaries; these were mostly brownish, and shrivelled at the tip. Evidently the fungicide had been absorbed in sufficient quantity to prevent normal root development; the root-

points being nearest to the point of absorption, whilst the influence of the water absorbed was sufficient to enable the stem to be pushed out.

EXPERIMENT II.—Seed steeped in Sulphate of Copper, 1 lb. to 5 gallons of water; one hour afterwards steeped in Lime-water two hours.

Name of Wheat.	Temperature.	Germinated in 6 days.	Short period of non-germination, 2 days.	Delayed. Germinated in next 3 days.
		per cent.		per cent.
Power's Fife	65° F.	70·04	......	14
Pererod	,,	43·4	......	2
Allora Spring	,,	72·6	......	11
Lambrigg White Lammas ...	,,	51·3	......	12
Bobs	,,	71·5	......	10
Australian White	,,	47·7	......	10
Nut Cut	,,	58·2	......	7
Steinlee	,,	51·7	......	5
Federation	,,	74·4	......	15
Australian Talavera	,,	70·3	......	17
Minnesota Blue-stem	,,	54·9	......	23

It is doubtful whether such as were delayed in germination would ever come to anything, for the plantlets showed themselves in such a way as to lead to the belief that they would not survive.

Experiment III.

In this experiment, for ascertaining the effect of steeping on different varieties, two fungicides were tried, conditions being made as even as possible. All chaff was removed. Blotting-paper being used, the water for maintaining moisture required being applied as evenly as possible. Temperature was fairly constant at 66 to 70, with no checks.

The methods adopted in preparing the grain were as follows:—

(*a*.) No treatment.

(*b*.) Seed put in sulphate of copper solution, 1 lb. in 5 gallons water, at 10 a.m., and thoroughly shaken. Taken out at 11·10 a.m., and put in lime-water; thoroughly shaken. Lime-water drained off at 1 p.m., and seed put between sheets of damp blotting-paper.

The liquid, after adding lime-water, was tested with ferrocyanide of potash, and with knife-blade; both tests showing no copper remaining in solution.

(*c*.) Seed put in mercuric chloride (corrosive sublimate), 1 lb. in 40 gallons, at 10 a.m., shaken up; taken out at 10·20 a.m., washed in three waters, remaining in the last until 1 p.m.; water drained off, and seed put between sheets of damp blotting-paper.

Without doubt washing prevents a certain amount of damage to the germs, as it would remove any poison remaining on the seed, and thus prevent it being absorbed with the moisture taken in as a preparation for germination.

Results were as follows:—

EXPERIMENT III.—Showing results in detail; experiment commenced 5th November, temperature varying between 66°–70° F. Medium—Wet blotting-paper; 50 seeds in each case.

Number.	Name of Wheat.	A. Not treated in any way.							B. Treated with Sulphate of Copper, 1 lb. in 5 gallons water, followed by 2 hours in Lime-water.									C. Treated with Mercuric Chloride.								
		Germinated as under. November—						Germinated.	Germinated as under. November—							Germinated by 10th November.	Delayed, spurious Germination.	Germinated as under. November—							Germinated by 10th November.	Delayed, spurious Germination.
		7	8	9	10	11	12	%	7	8	9	10	11	12	17	%	%	7	8	9	10	11	12	17	%	%
1	Cretan, grown at Lambrigg, 1902	22	25	1	...	1	...	98	23	1	...	...	...	4	15	48	38	33	6	...	1	5	...	1	80	12
2	Belotourka, Wagga strain, grown at Wagga; damaged by sprouting.	36	5	4	...	1	...	92	33	2	...	...	...	5	2	70	14	40	...	...	2	1	1	1	84	6
3	Medeah, grown at Wagga, 1898	36	14	...	...	...	...	100	20	5	...	...	...	2	13	50	30	17	15	...	4	4	3	3	72	20
4	,, ,, Lambrigg, 1902	42	7	2	...	...	...	100	27	3	...	...	...	3	11	60	28	32	10	...	...	...	1	2	84	6
5	Cretan, grown at H.A.C., 1901	25	18	5	1	...	...	98	43	1	...	...	1	...	1	88	4	41	4	...	1	...	1	...	92	2
6	Farrer's Durum, grown at Lambrigg, 1900.	48	1	...	...	...	...	98	21	2	...	2	1	6	8	52	28	21	...	...	3	...	1	6	48	14
7	Macaroni Wheat, No. 3, grown at Wagga, 1902; sprouted grain.	41	4	...	...	2	...	94	14	3	...	...	...	...	10	34	20	46	3	...	...	...	...	...	98	...
8	Xeres, grown at Lambrigg, 1896	41	5	...	...	1	..	94	9	6	...	...	...	1	14	30	30	12	6	...	4	3	2	3	44	16
9	Velvet Don, grown at Lambrigg, 1902	39	11	...	...	...	...	100	19	6	...	...	2	5	10	50	34	13	14	...	2	4	1	6	58	11
10	Cretan, ,, ,, 1896	11	38	...	...	...	...	98	36	7	...	...	...	2	...	86	4	14	9	...	8	5	5	3	62	26
11	F.R.I., grown at H.A.C., 1901	26	17	...	...	...	...	86	30	3	...	2	...	...	...	70	...	33	4	...	2	...	...	1	78	2
12	Xeres, grown at Lambrigg, 1902	34	15	1	...	...	...	100	25	2	...	...	1	14	...	54	30	39	7	...	1	...	1	1	94	4
13	Macaroni Wheat, No. 2, Pugh's R.R., grown at Wagga, 1902; damaged by sprouting.	20	13	...	...	...	...	66	18	6	...	...	1	1	...	48	4	31	6	...	...	...	...	...	74	...
14	Trit. Pol., grown at Lambrigg, 1896 ...	29	20	...	...	...	...	93	6	6	...	...	1	7	...	24	16	25	3	...	1	...	1	2	53	6

We may observe the results show bulk of seed germinated by third or fourth days in untreated and treated. This would, no doubt, be the best of the seed, and plants resulting therefrom might be expected to be hardiest. Plants resulting from such seeds as germinated afterwards may be expected to be smothered by the earlier ones, and would probably die out or result in stunted plants when growing in the field, through the earlier competitors being larger and naturally growing more rapidly, consequently obtaining the more favourable conditions.

Summary.

It may be concluded that—

1. Non-treated seed germinates more readily than treated seed. (Without reference to the effect on bunt or other smut spores; merely considering vitality.)
2. Steeping seed delays germination in a considerable proportion of the seed treated, in some cases killing the germ.
3. Those seeds which do germinate under delayed conditions sprout in a spurious way, the young stem frequently being pushed out first with no (or little) sign of roots, many rootlets being damaged at the growing point.
4. Sulphate of copper, in this test, acted more severely in causing delay in germination than was the case with mercuric chloride.
5. Treated seed was more free from mould than non-treated, though in some cases the treated seed showed mould, notably No. 13.
6. Varieties differ in their relation to treatment, as to the effect it has upon them; data are not at present sufficient for enabling this matter to be fully discussed.

During next wheat season it is proposed to repeat Experiment III, in order to confirm or amend results, slightly varying the conditions and at the same time including certain field tests, so as to try and arrive at definite results with respect to effect on field crops grown from treated seed.

Hawkesbury District—Farm Notes.

H. W. POTTS.

At this season no effort should be spared to make ample provision for abundant supplies of green stuff for winter use, and for ample hay to fill all requirements for the next summer, autumn, and winter. There are many farms upon which considerable areas of suitable land are allowed to remain idle all through the hay-growing season and where the occupiers spend every year considerable sums in the purchase of hay

and chaff. This is not good economy, because with reasonable care in preparation of the land, selection of suitable varieties of oats or wheat, and the use of a little manure where necessary, all the fodder requirements of this description can always be more cheaply grown on the farm than they can be purchased. At the College farm a good many experiments have been conducted with the object of determining, in the light of the peculiar climatic conditions of the districts to which these notes are intended to apply, the different kinds of oats and of wheat which can be relied upon to return the most certain results. Last season, in this district, rust was very prevalent, and of some twenty oats tried, the Algerian, as a crop for hay-making, showed its superiority. Two other varieties, Argentine, a variety very like the Algerian, and Red Rust-proof, were even better than Algerian, but cannot be recommended for extensive culture yet, because seed may not be obtainable in any quantity. Another very good variety is the Potato oat. Wherever possible the crops should be put in before the end of this month. In land that is naturally rich or has been heavily dressed with manure, the seed should be sown thickly in order to secure a hay with fine straw. The experiences of last season show that in choosing varieties of wheat to sow for hay crops, it is not only necessary to choose those which are resistant to rust, but which ripen early enough to escape the possible depredations of caterpillars. In dry years, and for the production of the heaviest crops of hay, White Lammas and Blount's Lambrigg have proved to be very desirable wheats, but during the past season some of the crossbreds that have been specially made by Mr. Farrer, Wheat Experimentalist to the Department of Agriculture, distinguished themselves, not only by resistance to rust, but also escaping the caterpillars by reason of their advanced maturity at the season of attack. At the head of the list of rust-resisters and early-maturers came Nutcut, Bobs, Sinew, Biceps, and Marshall's No. 3. Yandilla developed a little rust, but matured very early.

For grain for fodder the bearded varieties, like Medeah and Belotourka, are about the best. A good many farmers do not think it is worth their while growing wheat for grain, unless they can dispose of it as a market crop. In the coastal districts by far the most profitable use to which all the wheat grain that can be raised on the farm can be put is to utilise it in the rations of pigs and poultry. As a pig food, wheat can be made to fill a very profitable place in the list of concentrated foods utilised for rapid topping up of baconers and porkers.

In some districts barley is successfully grown for hay, but unless it is harvested at exactly the proper stage, some trouble may be experienced with the beard. The skinless variety does not have this disadvantage, and is as good, if not better, for hay.

Green fodders.—In the production of green fodder, much depends upon the condition of the land, and it will always pay well to get it into good heart, so that the crops may never come to a standstill. Oats, barley, rye, peas, &c., can be used alone or in combination. Where a big bulk of stuff is required, about the best combination is oats grown with barley. The barley, by reason of its more rapid

growth, will soon afford good grazing, and the oats will come along a little later, thus prolonging the period during which plenty of green stuff will be available, and afford a relishable change to the stock. Oats and peas—1½ bushel of oats to 1 bushel of dun peas or grey field peas—provide a well balanced ration for milch cows, as do barley and vetches, or tares where they can be sown early in well drained, old land. Another good crop for winter feed is Emerald Rye, which will do well in the light, gravelly soil that is unsuitable for more fastidious crops. Two bushels of seed per acre is the usual quantity sown, and in covering the seed should be buried at about the same depth as wheat or barley. This matter of covering seed in autumn-sown crops in districts where wet winters are always likely to be experienced, is one that needs care. It is all very well to sow seed at a considerable depth to help a crop to withstand conditions of drought, but very often—and especially where seed is scattered on roughly-ploughed land, a considerable proportion of the plants are exhausted before they push their way to the surface, and the growth of the crop is not as vigorous or rapid as is desirable.

Turnips and Swedes, if not already sown, should be put in without delay. It will always pay to put in a nice little patch of these crops, because even when the market falls to a low ebb, they can be turned to very profitable account as fodder for sheep, cattle, and pigs. It is in the event of market slumps, and of the production of any quantities of unmarketable produce, which are always likely contingencies, that some sheep come in so handy on a farm to eat up otherwise unmarketable material and convert it into profit. Pigs also serve a like purpose, but in a system of rotation, under which the object is to make good use of every square yard of a small holding, a small flock of sheep are invaluable. For the lambs there is always a good demand.

Lucerne.—Everyone should endeavour to have an area of this invaluable fodder plant. For the dairy cattle, for stall-fed horses, and for sheep and pigs, it provides the best of green forage, and as hay it is the best possible winter food either alone, or in combination with oaten or wheaten hay and straw, or with maize stover for idle horses, dry cows, young stock of all kinds, and as a general stand-by. The great point in getting good returns from a lucerne plantation is to take care to sow the seed in deeply-worked, clean land, so that the young plants which are for the first few weeks of their existence extremely delicate may suffer no check. Once the critical stage is passed, the lucerne can be relied upon to take pretty good care of itself. In some districts spring sowing is favoured, but on all farms where weeds have gained a good footing, there is considerable risk of spring-sown lucerne being smothered in its infancy. Sown in autumn, the young plants have a much better chance of establishing themselves without interference from weeds, and by the time the spring growth of weeds come up, the lucerne will have developed a good root-system and be better able to hold its own. Where pigs are kept, an area of even a quarter or half an acre of lucerne will be found of great use as a run for brood sows and litters. For poultry a small patch of lucerne will also be found useful as a source of one of the best green foods that can be provided for yarded fowls.

Farm Notes.

RIVERINA DISTRICT.—April.

Wheat.—Preparation of land intended for the production of wheaten hay should be completed without delay, as no time should be lost in sowing the varieties of wheat most suitable to the respective districts. Here the heaviest crops and the most palatable and nutritious hay are obtained from white wheats, such as Berthoud or Zealand, Australian Talavera, White Lammas, and White Essex. The sowing of wheat for grain crops should be commenced during this month, and completed by the end of May. The land should be ploughed to a depth of 5 or 6 inches, where the depth of the soil will permit, and pulverised as thoroughly as possible. Seed should at all times be sown with the drill, as thereby a considerable saving of seed is effected, and it is evenly deposited at an uniform depth of 2 or 3 inches, thus ensuring even germination and a much more equal growth of plants than is obtainable from broadcast seed. Drill with the seed for hay about 60 lb. of No. 1 or No. 3 superphosphate per acre, and for grain crops a similar quantity of No. 1 superphosphate. Sow seed for hay at the rate of 45 lb., and for grain 30 lb., per acre.

Barley should be sown without delay for green fodder, and the sowing for grain production should be completed by the first week in May. For green fodder, sow skinless or Cape, the former giving the earliest and best return where the rainfall is light. For greenstuff, use three-quarter bushel of seed to the acre, with the addition of one-quarter bushel of vetches or tares. For grain, sow 25 lb. to 30 lb. of seed, drilling with the seed about 60 lb. per acre of No. 1 superphosphate. For green feed, drill with the seed about 60 lb. to 80 lb. per acre of No. 1 or No. 3 manure, the latter for preference. For malting Kinver and Golden Grain have given best results.

Lucerne may be sown where it has a chance of getting a start free from weeds, which at this season are very liable to overrun it if the weather prove moist, otherwise it will be better to leave it till July or August. Land should be deeply broken, and the soil thoroughly pulverised, the surface being made even by rolling. Sow 8lb. to 10 lb. broadcast, but if drilled, less than half the seed will be enough.

Peas.—Sow grey or blue field peas, also varieties for table use. Of the latter, none will be found superior to Yorkshire Hero.

Vegetables.—Sow beet, parsnip, carrot, cabbage, onions, and cauliflower. Transplant into well manured and thoroughly prepared land such plants of cabbage and cauliflower as are fit.

Orchard Notes.

W. J. ALLEN.

For April.

The rainfall for the season has been fairly good and pretty general so that there are comparatively few districts where the trees have suffered to any appreciable extent from lack of moisture, yet, notwithstanding the favorable season there will not be half the orange crop this year that we had last, but the quality will, if anything, be better, owing to the fact that most of the trees are carrying only medium to light crops.

I would advise growers to refrain from rushing their fruit on to the market, as owing to the scarcity the demand will be greater than the supply, and any fruit which can be held over until the warm weather in the spring, will, in my opinion, command good prices. I refer more particularly to the orange and mandarin.

It is said that Victoria will not allow any fruit to enter that State which shows signs of either dead or live scale. It is, therefore, most important that our growers should endeavour to rid their fruit of all scales, either by fumigating or spraying, and this with as little delay as possible, as even after the scale is killed it takes some time for it to leave the fruit, particularly after fumigation.

Fumigating tables may be obtained from the Department of Agriculture on application.

In cases where the grower intends to give his orchard two ploughings, the first should be completed at as early a date as possible. Outside of this the land should have as complete a rest as possible until the winter ploughing, when all weeds which may have grown will be turned under while still green, and before they seed. It is now rather late to sow seed for green crops as there are very few crops which will make satisfactory growth between now and August, which month in most instances is quite late enough to do the winter ploughing.

Planting of citrus trees may be continued this month. When autumn planting is practised care should be taken in handling such trees not to expose the roots to either wind or sun for any length of time.

Codlin moth bandages must still be kept on the trees as, even after all the fruit is removed, an occasional grub finds its way to the bandage. All props should be removed from the orchard and any grubs adhering to them destroyed.

Trees badly disfigured by the ravages of woolly aphis, are a source of danger in the orchard as are also rough-barked varieties of either apples or pears, as in the ruptures caused by the woolly aphis will be found numerous grubs, as also underneath the rough bark, and it is a question whether it would not pay to cut all trees well back or down, which are in very bad condition, as I feel sure it will be impossible to

eradicate the moth while the trees offer such excellent harbor for the grubs. It is very noticeable when removing bandages that those trees which are badly disfigured with woolly aphis are rarely found to have many moths under the bandages, but in a close inspection of the knobs grubs may be found in all of them, and where this is the case there is but slight hope of ridding the orchards or district of this pest.

All dormant bud ties may be removed this month.

The stones and pits of the different fruits required for stock raising may be planted this month.

Trees required for refills or for planting new orchards should be secured as early as possible, and all land which is to be planted should be prepared without delay.

In purchasing trees, deal only with nurserymen who are known to have a good reputation, and who are raising their own trees, as it is to their interest to supply nothing but good stocks if they hope to do any future business. There is nothing more discouraging than to find after growing trees for three or four years that the varieties are worthless.

Growers in different localities often find that they have a variety which is doing exceptionally well in their particular district. In this case, if they are not sure of the name, and cannot get it properly named, I would recommend that they should send their wood to a nurseryman and have him work as many trees for them as they require. In this way they are sure to get exactly what they require and I feel sure there is not a nurseryman who would not undertake to carry out such a contract carefully.

Two or three good varieties are much better than two dozen, and one case of good fruit is generally worth as much as three or four cases of poor fruit—therefore, it is well to exercise great care to choose only the best if it is hoped to make fruit-growing pay.

To those who are interested in the subject of cider-making I would recommend securing a copy of the Report on the Results of Investigations into Cider Making, carried out on behalf of the Bath and West and Southern Counties Society, in the years 1893–1902, by F. J. Lloyd, F.C.S., F.I.C. This report can be purchased from Messrs. Eyre and Spottiswoode, East Harding Street, Fleet-street, E.C. It gives details in connection with the handling, storing, grinding, pressing, extracting, filtering, bottling, &c., &c. The report contains 145 pages, and its price in London is 8d.

The "California Fruit-grower" for November, 1903, contains a description of a new navel orange which is being grown in Florida. The bud from which the new orange originated was obtained in California. The fruit is named the "Surprise" and it is believed that it will do as well in Florida as the Washington Navel is doing in California. It is described thus—flesh, fine grained, yellow in color, juice, abundant, acidity and sweetness well blended; flavour, rich, vinous; quality, excellent; no seeds; ripens about the same season as the Washington Navel. It has fruited well for three years and is, therefore, looked upon as a decided acquisition by Florida planters.

The Department of Agriculture will try and secure some buds or trees of this variety as early as possible.

In the same number of the aforementioned journal is given the Teague process of curing lemons. Three things are insisted upon, viz.:—The lemons must never be allowed to sweat; they must never be in a draught or damp; and the yellow and green must be separated. Subject to this they are given all the air that can pass through a canvas covering in an open shed. Mr. Binney, a lemon grower of San Diego, is under the impression that lemons kept in Messina boxes in sheds, closed by canvas on all sides, except those from which the prevailing winds come, will cure equally well without canvas coverings for each pile of boxes. It would be well worth while some of our growers giving these methods a trial.

Practical Vegetable and Flower Growing.

W. S. CAMPBELL.

Directions for the Month of April.

Vegetables.

The rains of March, which spread over a large portion of New South Wales, assisted to keep many varieties of vegetables abundant; and as good rains frequently occur during April, any heavy work, such as trenching and preparing for the planting of permanent vegetables, had better be carried out whenever time permits.

Asparagus.—This is one of the best of the permanent vegetables referred to above, and should be planted in the early spring. It will succeed in almost any part of the State where other kinds of vegetables will grow. In most unexpected places it may be found luxuriating—far away in the West, for instance—where sufficient water can be provided for its requirements. When preparing land for this vegetable, unless the soil is naturally rich, a good deal of manure should be used, that is, horse, cow, fowl, or sheep dung, either separately or mixed together.

Beans, Broad.—During the month these may be sown as extensively as may be required, for this is about the best time of year to sow. Sow in rows about 3 or 4 feet apart and drop the seed about 4 inches apart in the rows.

French or Kidney Beans.—It would be unsafe to sow any more seed of this vegetable, except in those parts of the State which are not likely to be affected by frosts.

Beet, Red and Silver.—Attend to seedlings which have come up, keep them free from weeds, and thin out well. Further sowings had better not be attempted until the spring.

Borecole or Kale.—If it be intended to make a trial of this vegetable, sow a little seed.

Brussels Sprouts.—This is one of the very best of the cabbage tribe of plants, and should be grown wherever the climate may be found suitable. It will succeed best in cool or rather cool districts. Endeavour to obtain seed only of the highest quality, as there is a great difference in the merits of different kinds of seeds; and although the price of the best may be higher than other kinds, it is well worth the extra cost to procure the best. Sow a little seed from time to time, and plant out any seedlings which are well grown and which have been pricked out for the purpose. Use plenty of manure when preparing the soil for the planting.

Cabbage.—Sow seed from time to time as extensively as may be required, but there is no necessity to waste any seed. Plant out any young cabbages that are well enough grown.

Cauliflower.—Sow a little seed during the month, and plant out with a good deal of care any suitable plants which are ready. Do not stint the application of manure. All the cabbage family are gross feeders and need abundance of good food if the best results are expected. Cauliflowers need to be grown well from the start, and on no account should suffer any check, or they may produce nothing but "button" heads.

Carrots may be sown as extensively as may be required in drills about 1 foot apart. Drop the seed thinly and see that the seeds do not stick together. Thin out the seedlings well when they are large enough to handle.

Celery.—Plant out a few good strong seedlings in richly manured land. Water them well as they grow should the weather be dry.

Endive.—Sow a little seed. Plant out strong young seedlings as required.

Leek.—This needs soil that has been heavily manured. Sow seed from time to time and transplant the leeks when they grow to a height of 6 or 8 inches or so.

Lettuce.—Seeds of this vegetable may be sown as extensively as may be required during the month, and young lettuces may be planted as soon as they are large enough to move. They should be transplanted with care—lifting them so that as few roots as possible may be broken. The best way to manage this is to water the plants well, soaking the soil thoroughly before transplanting. Use plenty of good manure and try to bring the plants on quickly.

Onion.—This is a good time in which to sow seed largely. Use manure liberally, dig and drain well, and finish off with as fine a seed-bed as possible, and the more level it is made the better. Indeed, all vegetables will succeed best where the ground has been made quite level. Sow the onion seed in drills about a foot apart, and just cover the seed with fine soil. If pickling onions are required, sow seed thickly broadcast, preferring a white variety in preference to a brown or red. The white Spanish is an excellent mild sort, but the brown kinds keep best when stored for use.

Parsley.—Sow a little seed of this most useful herb, and never be without a few plants.

Parsnip.—Sow a few rows in deeply-dug soil. The parsnip is a very deep-rooting plant and needs good preparation if good roots are required.

Peas.—Sow largely from time to time during the month in rows, 3 or 4 feet apart, or they may be sown in double rows, as is sometimes preferred. When the peas have grown to a height of a few inches, stick in light brushwood or sticks along the rows, to enable the plants to grow to the best advantage.

Radish.—Sow a little seed now and then during the month to keep up a sufficient supply.

Shallots and Garlic.—Plant a few bulbs in rows, setting them about a foot apart in the rows.

Herbs.—Sow seed of any kinds that may be required.

Flowers.

Sow seeds of hardy annuals, of perennials, and biennials as soon in the month as possible, or it will be rather late to raise annual seedlings for planting out for early spring flowering. Spring flowering bulbs, such as daffodils, Watsonias, hyacinths, sparixis, tulips, anemones, crocuses, and others, should be planted without delay.

Cuttings of roses, pelargoniums, verbenas, fuchsias, carnations, petunias, and other similar plants, should strike well if set in carefully prepared beds during the month. But they will need looking after, watering and shading if necessary. If just stuck in the soil and left to themselves they will probably fail.

Everyone in the country who reads these directions should endeavour to grow and protect a few flowering plants, or some shrubs, or a few trees somewhere about the house and other buildings, and make the place cheerful with a few flowers here and there. Occasionally in the country may be seen the most beautiful flowers and plants, vegetables and fruits, tended with every care, even though the home may be small and humble enough. But, unfortunately, as a rule, the barest and most uncomfortable-looking dwellings and dismal surroundings are in evidence.

AGRICULTURAL SOCIETIES' SHOWS.

1904.

Society.	Secretary.	Date.
Royal A. Society	F. Webster	Mar. 30 to April 7
Bathurst A., H., and P. Society	W. G. Thompson	April 13 to 16
Richmond River A., H., and P. Society.	E. J. Robinson	,, 14, 15
Hunter River (West Maitland) A. & H. Association	W. C. Quinton	,, 19 to 22
Orange A. and P. Association	W. Tanner	,, 20, 21, 22
Quirindi District P., A., and H. Association	W. Cadell	,, 27, 28
Wellington P., A., and H. Society	A. E. Rotton	,, 27, 28
Central Richmond River (Coraki) Agricultural Society	D. Cameron	,, 28, 29
Upper Manning A. and H. Association	W. Dimond	,, 28, 29
Moree P. and A. Society	S. L. Cohen	May 3, 4, 5
Dungog A. and H. Society	Chas. E. Grant	,, 4, 5
Coonamble P. and A. Association	F. C. Lamotte	,, 11, 12
Nyngan and District P. and A. Association	R. E. Burns	,, 18, 19
Walgett P. and A. Association	Thos. Clarke	,, 25, 26
Cobar P. and A. Association	J. M. Scott	,, 25, 26
New South Wales Sheepbreeders' Association	A. H. Prince	June 29, 30; July 1, 2
Hay P. and A. Association	G. S. Camden	July 21, 22
Riverina P. and A. Association	Wm. Elliott	,, 26, 27
Condobolin P. and A. Association	D. H. Tasker	,, 27, 28
Narrandera P. and A. Association	J. F. Williams	Aug. 3, 4
Forbes P., A., and H. Association	N. A. Read	,, 3, 4
Parkes P., A., and H. Association	G. A. Seaborne	,, 10, 11, 12
Murrumbidgee P. and A. Association	A. F. D. White	,, 24, 25
Gunnedah P., A., and H. Association	J. H. King	,, 24, 25, 26
Grenfell P. and A. Association	Geo. Cousins	,, 25, 26
Young P., A., and H. Society	C. H. Ellerman	Sept. 6, 7
Junee P., A., and I. Association	T. C. Humphrys	,, 7, 8
Northern Agricultural Association	C. Poppenhagen	,, 7, 8, 9
Temora P., A., H., and I. Association	W. H. Tubman	,, 13, 14
Albury and Border P., A., and H. Society	Walter Johnson	,, 13, 14
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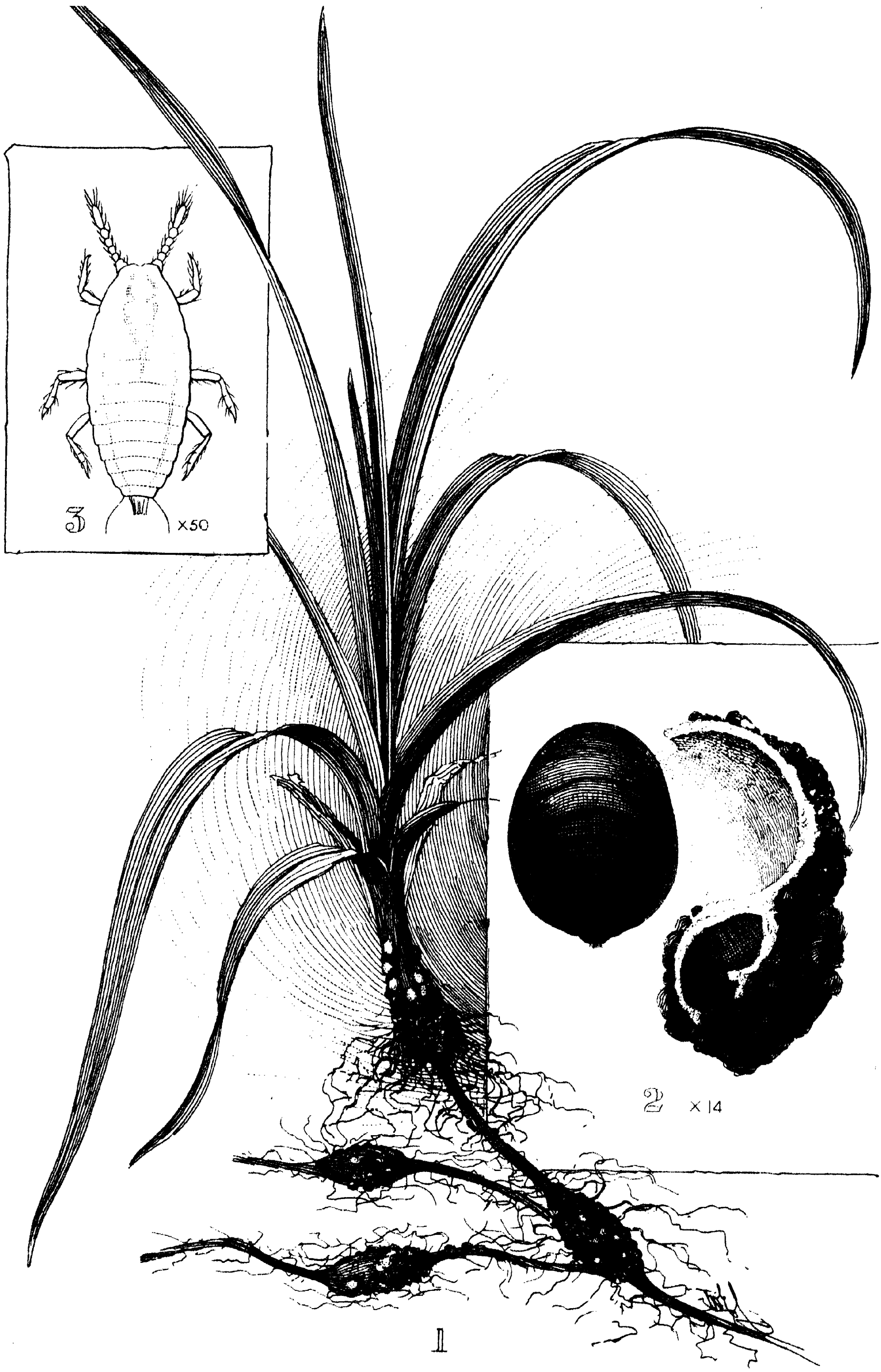

THE NUT GRASS COCCID.

1. A specimen of Nut Grass, showing the coccid on the roots. 2. A mature female coccid and sac. 3. The larval coccid.

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The Nut Grass Coccid.

(*Antonina australis*, Green.)

BY WALTER W. FROGGATT, F.L.S.,
Government Entomologist.

THE discovery of a useful scale insect is not an everyday occurrence; scale insects are always looked upon as the most destructive and serious pests that the orchardist and farmer have to deal with, and therefore a useful species is somewhat unique in the history of Coccidæ.

The insect in question is a pest in reality to its host-plant, the well-known "Nut Grass" (*Cyperus rotundus*); but this sedge—a native of Australia—has been washed down all our coastal rivers until it has spread over all the rich alluvial river flats as they become cleared and cultivated, and is now one of the worst plant pests that the farmer has to deal with when cultivating his land, so anything that will check its growth will be welcomed by the farmers as a friend, and more so when it is known that after several years this coccid has not been found to infest the roots of any other plants. The presence of this insect upon the nut-grass roots in the Singleton district has been known to some of the residents for about two years; they noticed the nut grass dying out in the paddocks, and digging the plants up found their roots "blighted." It appears that it was first transplanted by a fettler on the railway line at Ravensworth, who drew the attention of his superior officer to the fact that it might be used for destroying the nut grass on the line. In reference to this statement, Inspector Roberts writes:—"It was first noticed at Ravensworth a little over two years ago, and so far has not done extensive work, but has eaten out the nuts from the blue-metal ballast there for some distance, but does not seem to make good headway where the formation is hard. We have not found any north of Ravensworth, but have come across them in several places between there and Newcastle. I find to transfer them, it is better to take them in the soil, but without the soil they seem to live for a considerable time. I have kept them in my office for about a fortnight without soil, and they were still alive. It seems to take a good while for them to spread when transferred, but the work they do when they get a hold is to clean the nuts out and only leave a shell. I have not noticed them upon anything else."

In reply to further inquiries, Sub-Inspector Brown of Muswellbrook, wrote:—"I beg to state that I first discovered this scale insect about two years ago in the blue-metal ballast at Ravensworth, on the

Northern railway line. At this place there was one mile of the line one mass of nut grass, but the summer before last the nut grass came up only here and there, and that is how we discovered it was the insect that prevented it growing; last summer, and up to the present this year, there is no nut grass showing up in this particular mile of the road, but there is still a lot of nut grass at each end of the mile, and in the embankments alongside of the line, but it is slowly dying out. I find that the progress of this insect is very slow where the soil is stiff or clayey; in two vineyards adjoining the railway line at Ravensworth, the soil of which is of a loamy nature, the insect seems to be making fair progress. I may state that I have from time to time transferred a lot of the grass affected with the insect to other parts of the railway line, but the results have not been as good as I anticipated, why I do not know, but am of opinion the cause was the drought, as there was no moisture in the ballast at the various places when I transferred them; they are making very fair progress at Maitland and Singleton, but I have not yet been very successful in getting them started at other places further up the line. At Muswellbrook and Aberdeen, for instance, they have made very little headway. I have distributed a lot in other localities this spring, but cannot give you the result yet, but will be pleased to do so later on."

Though this coccid had been put to practical use for nearly two years, and several landowners had been transplanting it from infested paddocks into places overrun with nut grass, it was not until early in the present year (1903) that Mr. Henry Tyres of Singleton examined some specimens of the insects upon the roots of nut grass obtained in Mr. T. Thrift's paddocks at Dunoey, and furnished the local papers with an account of its useful habits, which brought it under the notice of the Department of Agriculture. Through the kindness of Messrs. Tyres and Thrift I was enabled to go round the district and examine fields only a few years ago matted together with nut grass, where now it is difficult to find a single tuft among the lucerne. It is noticeable that in lucerne fields and paddocks where the soil is least disturbed that the nut grass dies out much quicker than where it is ploughed up regularly, as the ploughing injures the infesting coccids, and also cuts up the nut grass, and starts a fresh growth.

A fine collection of infested plants were collected where a paddock had just been ploughed up, and the nuts could be easily seen encrusted with the white secretion of the female coccids clustering round the roots, as many as sixty insects being counted on a single root.

Each adult female coccid is enclosed in a thin white shell or coat of floury matter and firmly attached to the nut, the dull, purple-coloured coccid remaining in this position until the larvæ are produced, when she dries up. No larvæ were noticed until early in October, when a number of dull red larvæ crawled from under the adult specimens. This insect was forwarded to Mr. E. E. Green, Government Entomologist at Ceylon, one of our greatest authorities on the scale insects. He identified it as a new species of the genus, *Antonina*. This genus was formed by the French naturalist, M. V. Signoret, in the 14th Part of his "Essai sur les Cochenilles ou Gallinsectes," published in

Annales de la Société Entomologique de France, 1875. He described the typical form *Antonina purpurea* from specimens obtained upon the roots of several species of grasses growing in France, among them wild millets (*Millum*) and wheat-like grasses (*Agropyrum*), but does not state that the infestation of these insects killed the grass. Six other species of this genus have been described since from other parts of the world, *Antonina Nortoni* and *A. bouteloua* are described by Parrott upon the base of the stems of *Bouteloua racemosa* in Kansas, U.S. America; another (*Antonina Crawi*) found by Cockerell upon the bamboo growing in China and Japan, and the same entomologist described another from Kansas on grass roots under the name of *Antonina Parrotti*. Maskell, under the name of *Sphærococcus graminis*, added another to the list, found on grass roots in China. Newstead found the sixth (*Antonina socilis*) an the roots of *Arundinaria japonica*.

Green has determined this as a distinct species, for which he proposes the name of *Antonina australis*, a technical description of which is in my hands, and will be published in the "Proceedings of the Linnean Society of New South Wales." The adult female is a rounded white mass measuring $\frac{1}{8}$ of an inch in length, slightly longer than broad, and attached to the rhizome or nuts on the roots, up to thirty and forty of them being counted clustering together on a single nut.

When detached from the food plant the coccids break out of the white enveloping outer shell of secretion, and appear as a dull black mass, smooth and shining on the dorsal surface, but duller with distinct segmental corrugations on the under surface, within distinct spots, the indications of the aborted larvæ legs. On the tip of the abdomen are two stout irregular roughened tubercles, joined at the base with a tuft of stout bristle-like hairs below.

On the 16th of November, a number of freshly-emerged larvæ were observed crawling over a female still attached to the root. They were of a dull red colour, with the antennæ, legs, front of head, and tip of abdomen semi-transparent, elongate oval in form, flattened on the dorsal surface, and slightly truncate at the anal tip, the whole insect lightly fringed with fine hairs, and two longer ones standing at the tip. On February 5th, while examining nut grass grown at the Insectarium, the male coccid was observed crawling about on the roots. After this discovery was officially recorded, the Entomological Branch had a great number of letters asking for information about the insect that would kill nut grass; many of these inquiries came from Victoria and Queensland, and in them several of our correspondents asked for samples of infested roots to plant in their States. Before complying with their wishes, however, letters were sent to the authorities in both States, to explain what was being done, and several consignments forwarded. Those sent to Victoria arrived in due course, where they were forwarded to Mildura, but up to date no further information has been received as to the success of their acclimatisation.

The packages sent to Queensland were seized by the Inspectors under their Vegetation Diseases Act, and destroyed under the impression that this insect might become a pest upon cultivated crops.

Of course, there is always the danger that a root-infesting coccid may change its habits, and attack other than its natural food plant, and this was pointed out to our correspondents anxious to try experiments. To me this danger appears to be slight in this instance, as after two years the nut grass *Antonina* has not been found upon any other roots; and, secondly, that none of our grass or root crops are allied to or like the the underground rhizomes of this obnoxious sedge. Again, among the described species of the genus, all of them seem to attack only one kind of food plant. If the nut-grass coccid, under favourable conditions as in the case of the railway line, near Singleton, and in the lucerne paddock, can be propagated and used to kill nut grass in other places, it means an immense saving of labour to the owner of rich land infested with "nut grass."

I am carrying out experiments with these insects at the Insectarium where boxes containing clean nut grass, and others planted with infested roots are being cultivated so that the larval forms can be transferred under natural conditions and the development of the coccids observed. Other experiments are being conducted in a similar manner to see if they will attach themselves to the roots of sugar-cane; as regards the sugar industry, the successful introduction of the parasite into sugar lands without danger to the cane would be a very important event in economic entomology, as not only is the land impoverished, but the expense of cultivating it is greatly increased when thickly matted with nut grass.

Mr. Thos. Steel, of the Colonial Sugar Company, has recently forwarded some nut grass taken from a patch that appeared to be sickly, growing at the Homebush Mill, Herbert River, Queensland, that upon examination was found to be infested with this coccid, so that in all probability the range of *Antonina australis* will be found to extend as far as the nut grass.

The manager of the Homebush Mill reports to the company on 22nd February that a great deal of the nut grass about the plantation is dying from the attacks of this coccid, but it is not so noticeable in the cultivated land as in the grass lands.

Reports on New South Wales Butter in London.

Attention is directed to the reports in another part of this issue on the condition of New South Wales butters shipped to London.

Co-operation in the Wine Industry.

By V. R. GOSCHÉ.

Introduction.

It is now established beyond a doubt that Australia possesses all the necessary features required for the cultivation of the vine. Its range of climate is so extensive, and the characteristics of the soil are so varied, that wines of every description may be grown in one part or the other in our island continent. The reasons why our wines have not attained, on the whole, the excellence of quality which was expected of them have been pointed out frequently enough to require no reiteration. The cause of this partial failure is too often a want of the necessary capital by the aid of which the vigneron would be enabled to introduce into the vineyard and the cellar the best men, methods, and appliances procurable. Underlying this is a contracted market, brought about largely by the former conditions, preventing growers from obtaining such prices for his product which would place him in a position to obtain the much-needed reforms. The reasons for this state of affairs may be briefly summarised as follows :—

(1). *Absence of distinctive types.*—The types of wine grown in Australia are legion, and their quality often very inferior. In each district nature provides the material to produce certain characteristics, and any attempts to alter them by artificial means can only end in failure, or, if partly successful, must be attended by an enhanced cost in production. To grow port and sherry in localities in which either the climate or the soil, or perhaps both, are unsuitable, is an economic error which many are inclined to commit. On the other hand, to produce lighter wines where the natural features are adverse is no less unwise. Then, again, the adoption of a foreign nomenclature for the designation of our wines has been a mistake, and largely contributed to that result. Names distinctive Australian should be used. In most districts there exists much confusion of types owing to conflicting methods of vinification devoid of all intrinsic value. Nearly every grower imagines himself alone in the possession of the secret of wine-making, and many are so self-sufficient that they can see no good in the methods of their neighbours, and continue in the error of their ways. The absence of distinctive types is felt by merchants, who have built up their reputation and business by strict adherence to this requirement, and upon uniformity and quality. Acting as distributor, the merchant is hedged in by innumerable difficulties through not being able to obtain a regular supply, in such quantities as he requires, of those wines to which his customers have been accustomed. This entails upon him extra outlay in cellarage and

casks and enhanced costs in the handling and blending of wine. In consequence the selling price advances to the consumer and that of purchase to the grower falls in proportion.

(2). *Want of uniformity.*—I have already referred to the absence of uniformity amongst wines of a district. Every vintage shows marked differences over its predecessor. The same trouble is met with in the various cellars, where hardly two casks are ever alike. Slight differences between a number of casks do occur, but they are often so pronounced that the characteristics of a certain variety of grapes is entirely lost. Through this the local, as well as the export trade, has suffered considerably in the past.

(3). *Quality.*—There are some growers, still few in number, who produce excellent wines; others who, though their products may be classed as fair, do not seem to be able to bring out to the fullest degree the qualities inherent in wine, and more who, year after year, manufacture an article only fit for the still, to which it has to be eventually consigned. On that account there is an increase in the production of alcohol, chiefly used for the purpose of fortifying sweet wines, the consumption of which tends to vitiate the consumer's taste for the light dry varieties.

These reasons comprise the causes of our failure, and have consigned to the realm of platitudes the saying that the wine industry will rival, in time, the wool industry. The present difficulties growers have to contend against can be overcome and new vitality infused into the industry. What individual effort cannot attain may be secured by collective endeavour. Let growers confine themselves to the cultivation of the vine only, and, by means of co-operation amongst themselves, have their grapes manufactured into wine. It will relieve them, in a very short while, of the continuous struggle in which they are engaged against all kinds of adverse circumstances, take from their shoulders much work and anxiety, and place in their hands and control the management of a flourishing concern. Co-operative wineries and distilleries assure the following benefits :—

1. The production of the best wine and brandy under the most favourable conditions.
2. They facilitate the sale of wine.
3. They regulate the market.

Every one of these essentials should be sufficient inducement for the growers to enter into a union for mutual advantages, such as kindred societies have been able to give their members. Here, where high rates of wages prevail and great distances from the world's commercial centres impose upon the shipper exorbitant freights and insurances, the cost of production should be reduced as much as possible without impairing the efficiency of the service or the quality of the product. Co-operation not only holds out a vague promise to effect what is claimed for it, but there are innumerable instances to prove its value. Before entering into details relating to the operations and constituton of co-operative societies in viticulture, I first propose to review their history in Europe and in America.

The co-operative movement in various industrial pursuits is not a new idea. In Australia it is best known in connection with the fruit and dairy industries. Because these have not had an unqualified success, the inference is not necessarily that they are unsuited for our local requirements. Whenever the proper safeguards were applied, and the loyalty of members to the common good was maintained, they proved to be of material advantage to those connected with them. Failures are the exception, owing more to defective machinery than to principle. Trusts, though very similar, are aggressive, as a rule, and, hence, usually come to grief once the tide of public opinion sets in against them. These are mostly met with in the United States. It is different in the purely viticultural co-operative associations of Europe. Taking its origin in Germany, the movement spread to nearly all the wine-growing districts of the continent. Its introduction into the wine industry dates back to the year 1850, about the time when the Schulze-Delitoch banks first implanted in the rural population of the Fatherland a true conception of economic organisation. The original attempts were made along the banks of the Moselle, in Wurtemberg, and in Baden. These, however, attracted little attention, and it was not until some twenty years later that the venture received a fresh impetus in the picturesque valley of the Ahr. Phenomenal crops, lowered prices, and general depression of business, in addition to the manufacture of large quantities of wine brought about a crisis in the wine industry. Legislation against adulteration partly relieved the strain. Otherwise, everything appeared to combine to carry ruin and starvation into the homes of many vine-growers. The farming population is, of all classes, perhaps the most selfish and most given to individualism. Each works for himself with little regard to his neighbours or the latters' interests. Hard or extreme necessity alone will force them into united action for the general welfare. Bordering on the limit of the zone where wine can be grown at all, the vineyards of the valley of the Ahr frequently suffer from spring frosts or rains in autumn. Hence, the vines are cultivated on the slopes of hills so steep that the soil has to be kept in position by means of terraces, resembling huge staircases from a distance. Without a visit to the district it is difficult to realise how those inclines can be put to such use. Yet, is it done, and, if this instance illustrates the strenuous efforts required by the vignerons to ensure to themselves a living, it also demonstrates the better the soundness of co-operation. The exceptional costs, which the cultivation of the vine exacts in the valley of the Ahr demands high prices for the product to leave any margin of profit. But this margin became less in every succeeding year, and eventually disappeared altogether, when the merchants made a new departure by purchasing grapes, and manufacturing their own wine. At first, this seemed to be a very desirable end to the growers. In the long run, it turned out differently. Having no further use for them, their cellars fell into disuse, casks and appliances became obsolete, and, worst of all, vignerons lost all knowledge of wine-making. From that moment they were at the mercy of the merchants, who were, certainly, not slow to make use of the their advantage by offering any prices they felt

inclined, until they even ceased to pay for working expenses. In time the middleman not only made all the profits, but, in too many instances, became possessed of the properties. Numbers of growers were ruined, having to leave hearth and home to make a fresh start in other districts, or even in foreign countries. This could not continue, and those growers, therefore, who had so far escaped the general ruin decided to make a determined stand against their aggressors. They fully realised that this could only be accomplished by means of concerted action. They formed themselves into associations, now known as Winzervereine or Weinbanvereine, for mutual defence and benefit. The difficulties they met were great; organised opposition had to be overcome, mortgages and loans had to be adjusted and repaid on the shortest possible notice and above all, the novelty and uncertainty of the new venture and its ultimate success presented few features of attraction. The most experienced men of business might have had apprehensions when embarking on so novel a scheme; how much more so those peasants. But stout hearts and determination triumphed over all obstacles. At present there are in the valley of the Ahr over twenty-five societies of from 50 to 150 members in each, controlled by a central union at Ahrweiler. They soon took root along the Moselle and the Rhine, in Wurtemberg, round Weinsberg, Beilstein and in other localities. One of the most successful ones is that near Heilbronne, which enjoys the moral and material support of the municipality of that town. Co-operative associations amongst wine-growers are also prevalent in Baden, Bavaria and Alsace-Lorraine. Colmar boasts of a wine exchange composed of about 150 proprietors of the principal vineyards of Alsace. Sending out wine under a guarantee, its object is to prevent adulteration and to place the product of its members in the best and cheapest manner before the public. I have dwelled at some length on the Winzervereine of Germany as they may be regarded as the basic principle of these associations in other countries. Their constitution will also be more particularly examined for that reason. They are now strong and self-contained, possessed of luxurious business establishments, immense cellars containing many millions of gallons of wine, thousands of pounds in their reserve funds, distributing depôts everywhere and absolutely free of liabilities. All this has been accomplished by small growers. The success which attended their united efforts amply justified the wisdom of the venture. At home their own masters, they owe allegiance to the central body, which buys from them their grapes and converts them into wine.

There is little difference between the Kellergenossenschaften of Austria-Hungary and the Winzervereine of Germany. They receive every encouragement from the Government of the country and their statutes are regulated by the Board of Agriculture.

The co-operative system has likewise asserted itself in Switzerland, where growers belonging to these associations receive from 25 to 30 per cent. more for grapes than outsiders do. Prices are regulated by the position of the vineyard, its management, varieties of vines, and by the density of the must.

Like the rest of Europe, Italy also experienced the effects of the viticultural crisis. The position became particularly acute at the time of the commercial rupture with France. The Italian Government realised that something had to be done to extricate a national industry, involving millions of money, from difficulties which threatened to overwhelm it. By means of legislation it encouraged the formation of co-operative associations amongst wine-growers and merchants. The first Cantina Sociali was established at Sondrio in 1872, about the same time when the movement received its main impetus in Germany. Distributed over the whole of the peninsular, these societies serve to illustrate, no less than the Winzervereine, the remarkable advantages derived from co-operation. At present, there are four distinct types of them, viz., co-operative wineries, co-operative distilleries, co-operative societies for distribution and viticultural exchanges. The movement has been throughout progressive and successful. In addition to the pecuniary advantages they offer they exerted a considerable moral and educational effect upon the vine-growers. They tend to disseminate knowledge bearing on viticultural pursuits, oenology and commercial transactions. The Cantina Sociali of Montserrat is a striking example of their phenomenal success. Founded in 1901 with 200 members, it now has a membership of over 1000 and is constantly on the increase. Each member contributes 2s. per annum, payable at the rate of two pence per month. In any locality in which there are twenty members at least they are constituted into a branch. The various branches are controlled by a central union.

In 1901 the first energetic steps were taken in Portugal to assist the wine industry. By a decree of 14th June the Government relieved the manufacture of wine and spirit from certain excise duties which had hitherto handicapped their production. It also encouraged the formation of wineries by exempting them from licenses and stamp duties, provided they did not engage in commercial transactions, but confined themselves to the making, conservation, schooling, blending, and bottling of wine. They are permitted to acquire alcohol and concentrated must for purposes of improving the product of their districts. The Government further promoted the formation of eight co-operative associations, which they assisted financially under certain conditions. They had to be "Improved viticultural establishments having for object the collection of large quantities of wine to blend them into types suitable for home consumption and for export." But as they had to confine themselves to the making or of maturing wine, an outlet for the sale was found in another direction. This was attained by a promise to subsidise a central association at Lisbon, having a capital of not less than 5,000 cantos de reis (£1,200,000) for the purpose of developing the export trade by means of exhibitions, advertisements, agencies, and by establishing depôts in Portuguese colonies. The authorities likewise encouraged the manufacture of brandy, raisins, and tartaric acid. Private associations, independent of Government, are numerously in existence, and the industry is extricating itself by degrees from the critical position it was in a few years ago.

Of all wine-growing countries, France has been most backward in adopting the co-operative scheme. This land of "Fraternity" has individualism, strange to say, more deeply ingrained in its rural population than in those of almost any other part of the world. No serious attempts have as yet been made there. Old customs and prejudices, however, are giving gradually way to the more modern ideas, forced upon the growers by necessity. Crops were very prolific of recent years, and stocks of wine are accumulating in consequence. Although adulteration has been surrounded by legislative restrictions, excessive excise duties and licenses still continue to hamper the industry. The laws affecting syndicates are not sufficiently elastic to encourage the formation of co-operative societies. As these barriers are being removed by degrees and a more healthy spirit asserts itself, we may see, before long, the same benefits reaped by the vignerons of France which those of other countries have secured. Compared to those already mentioned, the co-operative wineries of France are insignificant. This completes a short history of the movement in Europe.

Similar companies are established in America. Of these the California Wine Association may be considered one of the most representative. The climax in the wine industry of California was reached in the year 1880, when the outlook appeared very gloomy owing to over-production, cultivation of unsuitable varieties of vines, and antagonistic action amongst interested parties. With the introduction of co-operation a better state of affairs asserted itself. Old vinyards were extended and new ones planted. Prices for grapes were very low last year in San Joaquin county and created a movement towards co-operation amongst growers. Knowing the enterprising spirit of our American cousins we can safely surmise that this will, probably, be accomplished without much loss of time.

Objects.

The objects of co-operation in the wine industry are, as quoted from the articles of association of one of the Winzervereine, to say the least very pretentious, but have been more than attained. They are:

(*a*) "The improvement of the cultivation of the vine."

This is carried out by means of inspectors, whose duty it is to visit the vineyards of members, to see that varieties suitable to the soil and climate are grown; that the operations and work are properly executed, and the vines are kept free of disease. When we recollect that much of the mischief met with in the wine-cellar is introduced from the vineyard, and that prices obtained for grapes by shareholders are largely regulated by the condition of their vines, we can realise the importance of such a provision.

(*b*) "The conversion of grapes grown by members into wine by the most rational and economic methods."

It is natural to conclude that a body with strong financial resources is better able than the individual to make wines of uniform and

superior quality, while at the same time reducing the cost of production. Until such time that the society is in a position to erect central cellars the economy practised will not be very marked; but from the moment the society has its own premises and all operations of vinification, blending, and schooling of wine are carried on under one roof the saving will be considerable through concentration of energy and labour.

(*c*) "The sale of such wine, either direct or indirect, to the consumer."

The wisdom of confining sales to merchants only or to deal with the consumer must be regulated by local requirements. Some wineries restrict themselves to dealing with the trade, while others engage also in distribution.

(*d*) "A limited purchase of grapes or wine from outsiders for the purpose of improving the wines of the society, such purchase to be made in exceptional cases only."

To empower the committee to do so is a wise provision.

(*e*) "The treatment and sale of the by-products of vinification."

Every year vignerons lose money through their inability to extract from the residue of the vintage the tartaric acid it contains. There is always a ready market for this. What cannot be done or is not worth prosecuting by the individual may be effected by combination. The society, dealing with the products of all its members, is in a better position to acquire the necessary plant for the purpose of manufacturing tartaric acid, &c. Profits are often considerably augmented through utilising and selling the waste products of the wine or any other industry.

(*f*) "The purchase of the necessary plant used in vinification, &c."

This implies the purchase of casks, machinery, and other appliances for the manufacture of wine and brandy, all of which are again alluded to under expenses. They become part of the assets of the society, and may be bought from the shareholders, or elsewhere, as circumstances point out. It also refers to the construction of central cellars, as soon as the funds of the society permit of it. The society should be careful not to incur any more debts at the start than necessary. The most convenient establishment of members may be used until the funds allow of their erecting a central cellar. Here may be carried on the work in connection with wine-making and its conservation. During this term the society agrees to keep them in good order, ordinary wear and tear excepted. As soon as the position of the society is assured, and its funds sufficient for the erection of central cellars, it should be proceeded with at once, as it is not until this is done, that any of the economies and other advantages co-operation offers can be made available. Here, as in all else, prudence must point out the right moment. Haste should be avoided, but procrastination no less.

Constitution.

Although the constitutions of various societies differ in details, they are all framed on similar lines. The committees and officials charged with their administration may be more or less numerous, and their powers more or less comprehensive. Without entering into particulars, I propose to describe the constitution of an average association. The administrative body consists of:—

(1) The general committee or council, composed of a president, a vice-president, a treasurer, a secretary, and a number of councillors. They are elected for one, two, or three years, as the case may be. In some instances the chairman of the general committee becomes *ipso facto* the president of the association. Where no vice-president is specially appointed, that position is filled by the senior councillor. With the exception of the first four, the duties of councillors receive no remuneration. They are, however, reimbursed for all personal expenses incurred on behalf of the society. The general meeting of members may grant them a supplementary indemnity. The general committee attend to the society's business, effect purchases or sales, engage the necessary labour, and regulate all internal affairs. They may also act as a board of arbitration to adjust differences arising between members. In cases of disputes between the committee and members, the appointment of two arbitrators is provided for, who in turn, should they disagree, may nominate a third. The decision of the arbitrators is final, and members renounce all rights to appeal to law against them.

(2) The committee of surveillance, consisting of three to six members, is elected at the annual general meeting of shareholders. Their term of office is six years, but every third year one-half of their number retire for re-election. Independent of the general committee, their duty is to exercise a controlling influence over the latter, and to generally safeguard the society's interests.

(3) The valuation committee consisting of three members, is a body of experts, entrusted with very important duties. They are charged with the supervision of vineyards appertaining to shareholders, and the examination, classification, and valuation of wines and grapes. This valuation is only a provisional one to serve as a basis, later on, for a proportionate distribution of the net receipts during the current year, and, also, for any advances made to shareholders by the society. Each member receives a receipt for his goods, describing the nature of the product, its quality, and its approximate value. All valuations are made in the presence of the vendor, who may appeal to the president if he considers himself unfairly treated. No appeal can be made from the latter's decision on the strength of fresh inquiry.

(4) The General Meeting of Shareholders.—In the body of shareholders are centred all the powers necessary to conduct the business of the association. They delegate them to the various

administrative committees as they consider circumstances demand it. They meet twice a year regularly, viz., in spring and in autumn. The president, on his own initiative, or at the requisition of a certain number of members, may call them together whenever required, provided due notice be given and the reasons are stated for which the meeting is called together. Each shareholder has a vote, minors and women excepted. These are represented by another member. Fines are imposed for absence from meetings without reasonable cause, a practice which should be adopted in other similar concerns. The annual general meeting appoints the committees of administration, and the auditors, regulates salaries, receives the usual report and balance sheet, decides upon the amount to be paid into the reserve fund, determines upon the liquidation of shares, and distribution of dividend, and upon all other matters on the recommendations of the general committee. The general meeting also deals with fines, entrance fees, suspension of officers, and expulsion of members from the society.

The duties of members towards the society are strict. This is absolutely necessary; upon the loyalty of members towards each other and towards the general body depends the whole success of the venture. The enjoyment of full civic rights is, in some instances, a condition for admission. The applicant must be the proprietor of a vineyard in the district to which the society he wishes to join belongs. When making an application for admission it is done by registered letter in which he declares his willingness to conform to the articles of association and to follow all instructions affecting the welfare of the association given him by the committee or its representative. When accepted he pays the usual entrance fee, the amount of which may be altered from year to year by the general meeting. From this are exempt the widow of a defunct member, an ex-member who may have temporarily left the district, or anyone marrying a woman belonging to the association. In some associations there is no appeal should a candidate be rejected by the committee, who are not bound to give any reason for their action. Every member agrees to remain a specified number of years in the society and forfeits all rights on non-compliance with the rules. When expelled he is still held responsible for his share of the society's liabilities for a number of years from the time of expulsion. The society may reserve to itself a limit of three months after the close of the financial year at which a retiring member took part, during which to liquidate any obligations towards him. Members bind themselves to sell all their grapes and wines to the association if approved by the committee.

Income.

The resources of the Winzervereine are :—

(1) Shares, of a nominal value of from 50 to 100 marks (£2 10s. to £5), or whatever sum may be decided upon. The payment of these may extend over a number of years and a

certain amount deducted from the profits (if any) accruing to members at the end of each year. Shares can only be transferred with the consent of the society, which shall also have the power to repurchase them whenever necessary. The shares bear interest, which is included in the expenses of management and payable before distribution of the dividend ;

(2) Entrance fees, according to arrangements and subject to alterations by the general meeting of shareholders ;

(3) Fines, for breaches of regulations; these become the absolute property of the society and are added to the reserve fund ;

(4) Loans, negotiated with a financial institution, in the manner provided by the articles of association ;

(5) Proceeds from the sale of wine ;

(6) Income derived from the sale of spirit, tartaric acid, and other by-products of the grape.

Expenditure.

The expenses of co-operative associations comprise :—

(1) Cost of management and wages.

(2) Debts incurred through purchase of movable goods (casks, plants, &c.) and immovable goods (vineyards, cellars, &c.). Should the committee of management consider it expedient to buy the plant and appliances of shareholders they have the power to do so. Some associations, also acquire vineyards; but this depends upon their constitution and must be regulated by local circumstances.

(3) Purchase of Grapes and of Wine.—Here, I must arrest myself for a moment, this being a very important article, as the success of the undertaking naturally depends upon the quality of the goods it places on the market. If the quality of either their grapes or wine is deemed sufficiently good by the valuation committee, shareholders must sell them to their society. If they are not up to the required standard, the association is in no wise bound to purchase them. The acquisition of these goods demands expert experience. In addition to the condition and aspect of the vineyard, and the varieties of vines grown, the following factors must be taken into account when it is a question of grapes :—

(*a*) The Sugar.—The amount of sugar in the grape determines, under normal conditions of vinification, the alcoholic strength of the wine, and hence serves as a basis for the selling price. A sliding scale is usually adopted to allow to each member the full value for his products, and, while encouraging the planting of the best varieties of vines, holding out no inducement to malpractices in the shape of adulteration.

(*b*) Amount of Acids.—No less essential to regular fermentation and the conservation of wine.

(*c*) Flavour, Perfume, Bouquet.—These are more difficult to estimate, yet materially influence the commercial value of wine. All of them are acted upon by a variety of factors, and are developed in the course of maturing the wine. Hence, it is an extremely hazardous task to determine them.

(*d*) Colour.—The colour of the future wine does not merely depend upon certain matters in the flesh and skin of the grape, but is regulated by the alcoholic fermentation and a number of chemical reactions during the period of schooling and conservation. We do not give sufficient consideration to the colours of our wines. The reds are frequently too dark, and the whites of a sickly colour. Not only the degree but also the shade of the colour must be studied, especially if we intend to persist in the practice of reproducing, in Australia, the wines of other countries. To ascertain from the grape the amount of colour a wine is likely to have is not an easy matter, and calls for a good deal of judgment.

(*e*) Yield in Must.—The amount of juice must be carefully ascertained, and the yield of each variety registered, not merely for immediate use, but as a basis for the distribution of profits at a later date.

In connection with the purchase of wine, the foregoing conditions are modified—alcohol, colour, and others, being then present in estimable quantities.

(4) Creation of a Reserve Fund.—Until all debts of the society are paid, 50 per cent. of the profits are annually set aside for that purpose every year. When that object has been accomplished, 10 per cent. only are reserved until the fund has reached a certain sum, after which the whole of the profits are distributed amongst shareholders. Fines are also added to the reserve fund.

(5) Payment of Dividends or Distribution of Profits.—These are allotted to members *pro rata* of the price of grapes, must, or wine sold by them to the association. As members are entitled to their share of the profits, so also are they liable, in the same way and degree, to be called upon to contribute from their private resources towards the liquidation of the society's indebtedness.

The assets of the society, including the reserve fund, belong absolutely to the society. Should its dissolution be decided upon by three-fourths of the shareholders, the proceeds arising from the sale of the property are distributed, after payment of liabilities, amongst members, in the same manner that the profits or losses were allotted the previous year. In case of loss corresponding to nine-tenths of the capital, the managers must convene a general meeting of members, who will then deal with such dissolution. There are few instances on record in which this step had to be taken.

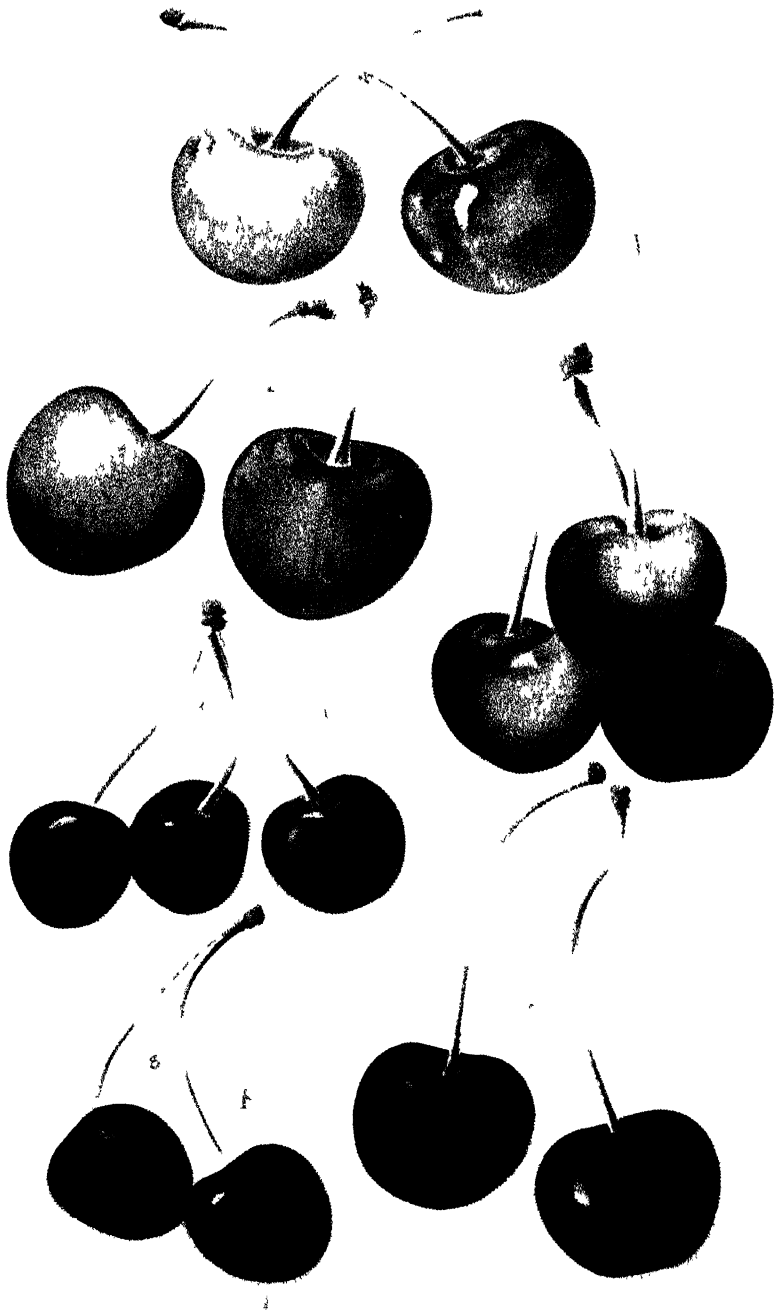
Conclusion.

In the foregoing, I have given an historic sketch of the co-operative movement in the wine-industry of Europe, aud briefly traced the constitution and objects of one of these associations. To fully appreciate them and comprehend the mechanism of their administration, we require to study them on the spot, where we can realise more fully the splendid work they have done. They have accomplished, practically, all that was claimed for them. The phenomenal success achieved by the Winzervereine of Germany, and the Cantini Sociali of Italy, have dissipated all doubts on that score. Native customs and local conditions call for modifications easy enough to introduce. But, whether they are purely wineries or distilleries, or both combined, and whether they confine themselves to production only, or engage also in distribution, is really a matter of detail. Any of them will flourish under proper management. In Australia I would advocate not to interfere with the retail trade, but if local consumption is too restricted, to rely on the export of our wines. I strongly recommend to growers the adoption of the co-operative principle. By its help the surplus stocks of good wines of which our cellars are full could be conveniently disposed of, while the inferior kinds, of which there are unfortunately too many, could be, after conversion of into spirit, used up in some shape or form. Co-operation has the great advantage of giving quick returns to the small growers, who are always anxious to secure a reward for their labours quickly and expeditiously.

Treatment of Cuttings from Vines which have been Infected with Black Spot.

As the Black Spot has been so prevalent this year it is thought nurserymen and others who are sending out cuttings may appreciate some notes as to the best means of minimising the risk of conveying infection by such means to uninfected vineyards.

The Viticultural Expert advises that the cuttings should be placed for twenty seconds in a solution of sulphate of copper (bluestone), 2 per cent. in strength—that is, 1 lb. of sulphate of copper dissolved in 5 gallons of warm water, and allowed to become quite cold before use. After immersion in this solution the cuttings should be placed in a well-ventilated shed and allowed to dry. They should not be packed while moist. Before planting cuttings so treated, the two ends of the cutting should be trimmed by making fresh cuts until the live and fresh tissues are exposed.



The Cherry.

W. J. ALLEN.

THE demand for this fruit is increasing from year to year, and up to the present time in Australia it finds a ready sale, chiefly for dessert purposes, for which it is everywhere highly esteemed. It is also found in many collections of bottled fruits, where it has been carefully put up by the housewife, to be opened later on when the fresh fruit is out of season, at which time it is greatly appreciated.

The early season at which it ripens, its juiciness, delicacy, and richness, render it always most acceptable; and it is held in high estimation wherever cultivated, as not only can it be eaten uncooked but no other fruit can surpass it when used for pies, puddings, &c. The varieties most suited for this latter purpose are the tender and more or less acid sorts, and which, strange to say, have not up to the present been so extensively planted as the larger, sweeter and more fleshy varieties. The fruit of the Kentish, Early Richmond, and other varieties is excellent when stoned and dried, and the Mazzard and wild cherries found growing in America are used to give a flavour to brandy, which is called cherry brandy.

Stocks.

Seedlings from the Mazzard and Morello varieties make excellent stocks, the former for all strong-growing varieties, and the latter for the Duke, Kentish, and Morello varieties. Stocks from cuttings make more dwarf trees than do those from seeds. I would therefore recommend the use of seedlings only.

The Mahaleb dwarfing stock is often very successfully used for the smaller varieties of cherries.

Raising Seedlings.

The fruit should be allowed to become thoroughly ripe before picking; after which, gather and allow it to lie in a heap for four or five days, when the stones may be easily removed by rubbing the fruit over a sieve and washing it. This will remove the pulp from the pits. After this process the pits should be dried for a day or two, being stirred occasionally. This will give the outsides of the pits time to dry sufficiently to prevent moulding, while the kernel will remain fresh. They should then be placed in moist (not wet) sand, and kept in this condition until the fall, when they may be planted in seed-beds or rows in good, rich, mellow soil, previously prepared for the purpose. They should never be allowed to become perfectly dry, else they will not come up the first year, but many of them may, if left undisturbed, come up the following spring. It is usually more difficult to get the Mazzard to start than the Mahaleb. If the stocks are

raised in a seed-bed they require to be set out in drills, where they will be well cared for until they are large enough for budding or grafting.

Budding.

The stocks should be growing freely at time of budding, which operation is usually best done the latter part of January and February, and while the sap is flowing freely, at which time the bark will lift readily. Buds should be taken from good-bearing trees, and may be inserted as described in the *Agricultural Gazette* from time to time. Briefly, a lengthwise incision is made through the bark of the stock, and a small cut at right angles at the top—the whole resembling the letter T. The bud is then cut from the scion and inserted without removing the wood adhering to the bud, which latter process is quite unnecessary and a waste of time. The following winter the top of the young stock is cut off to within a few inches of the bud, and all suckers taken off, leaving only the young bud in possession. When the latter is from 6 to 9 inches long it may be tied to the top part of the stock; and when the young tree is strong enough to support itself that portion of the stock which was allowed to remain may now be cut off close to the point where the bud leaves the stock. The fresh cut may be covered with white lead or grafting wax.

Soil and Situation.

Cherries are found doing well on almost all of our good well-drained soils in the cooler districts, where the elevation is over 1,000 feet, but they do best where the elevation is from 2,000 to 3,500 feet above sea-level.

In the Orange district and on the Canoblas is found soil second to none in Australia for growing this fruit. Again, at Armidale can be found splendid land and good cherry orchards, and at Goulburn and surrounding districts can be found some splendid cherry land.

To ensure regular crops it is best to choose a fairly high elevation so as to avoid as far as possible the heavy frosts which are responsible for the failure of many of the crops on the low-lying lands. Occasionally the higher levels suffer, but not often. Trees will do well on a light, well-drained soil, but often fail in the tight clay soils. Subsoil draining may help in the latter case, but it is best to avoid planting on such soils.

Transplanting and distance to plant.

It is well to have the ground in good order, so that the trees may be planted during June or July, not later, and the larger growing cherries such as Heart and Bigarreau varieties should, on good soils, be planted from 25 to 40 feet apart, while the smaller growing varieties may be planted from 20 to 25 feet apart, according to the quality of the soil. In any case, err on the safe side by giving them plenty of room, as during the many dry seasons which we must expect to encounter in Australia the trees will have more ground from which to draw moisture, and will in consequence be in a better position to withstand the drought than if planted too close together.

It must not be forgotten that while this tree does best in a well-drained soil, still it requires more moisture than many other fruits. Cherry trees are usually the first in the orchard to show signs of distress during a drought. In planting a tree, see that it is set about the same depth in the soil as when growing in the nursery, and see that the roots are carefully spread before they are covered with the soil.

Fertilisers.

Generally speaking, the cherry requires as little fertiliser as any fruit grown. An occasional crop of black tares, grown in the winter and ploughed under in the spring, will be found beneficial.

The mineral constituents of the cherry are—Potash, 51·85; soda, 1·12; magnesia, 5·46; lime, 7·47; iron, 3·74; phosphoric acid, 14·21; sulphuric acid, 5·09; silicic acid, 9·04 Phosphoric acid, potash, and lime are the chief ingredients taken from the ground and hence needing to be restored to it to retain its fertility.

The following would be a good manure to use where barnyard manure is not available, and is recommended by Mr. Guthrie in his pamphlet on formulæ for preparing fertilisers :—

Sulphate of ammonia	250 lb.
Superphosphate	620 lb.
Sulphate of potash	250 lb.

Apply at the rate of from 3 lb. to 6 lb. per tree according to the age and size. Mr. John Wright in "The Fruitgrowers' Guide" gives the following mixture as being good :—

Steamed bone-meal ...	3 cwt.	mixed per acre.
Sulphate of potash ...	$1\frac{1}{2}$,,	
Chloride of soda ...	$\frac{3}{4}$,,	
Sulphate of magnesia ...	$\frac{1}{2}$,,	
Sulphate of lime ...	$5\frac{3}{4}$,,	

The mixture to be applied never later than the swelling of the buds. The same authority also recommends that if the trees crop heavily to apply $1\frac{1}{4}$ cwt. of nitrate of soda per acre soon after the fruit is set. Some of our good basalt soils would not require such liberal dressings, but there is no doubt that some such applications will have to be given if the trees are to be kept producing regular crops of first-class fruit.

Pruning.

While the same general rules which apply to other fruits also apply to the cherry, yet it will be found best to modify the treatment in some of our warmer districts, and in those where the soil is not altogether favourable for their growth, as we find in many places that if too severe pruning is practised, after the second or third year the tree is apt to gum badly and perhaps die.

In some districts, particularly where the soil is of a deep, rich basaltic formation, gumming is not so prevalent, and the trees do much better. Many of our old growers have not followed very drastic methods of

pruning after once the tree was well established with, in many instances, fairly good results. However this neglectful system, or, I should say, want of system, cannot be recommended, as a certain amount of thinning out and nipping back is always necessary, and perhaps more for the first few years than later. This is best done while the tree is growing—either just after the fruit is picked, or just as the buds are bursting in the spring. This latter season I prefer.

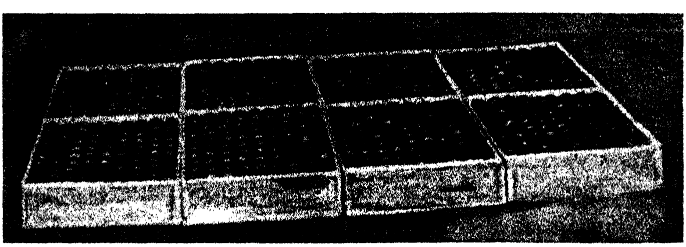
In removing part of a shoot or branch, always cut back to a leaf bud or a new shoot, but never to a fruit bud, as it is difficult to get the latter to throw out good wood. In starting branches out of the trunk of the tree, care must be taken to see that they are at good distances apart from each other, and that they start more at right-angles than in a triangular shape.

Cultivation.

The cherry orchard should receive the same care as regards cultivation as other fruits. During the summer months it should be kept free from all weeds, and should receive constant cultivation to keep the ground from becoming hard, because if allowed to harden and crack the moisture soon evaporates. On the other hand, if the cultivator is kept at work, the loose soil on the top acts as a mulch, which, in its turn, assists in retaining the moisture which is so necessary for the well-being of this tree. The horses, plough, and cultivator should be made to do most of the work, hand-work being confined to that portion of the soil lying close to the trunk of the tree and out of reach of the cultivator.

Picking and Marketing.

Many varieties of the cherry are most delicate, and very susceptible to injury; therefore the fruit must be handled most carefully, and should be gathered with the stalks intact, separating them carefully from the spurs or branches, as they keep much better with the full stalks. The fruit should be gathered when dry, and *under* rather than



Showing how Cherries should be packed.

over ripe, and the bloom preserved on varieties which show any. The proper way to handle the fruit is by the stems. Varieties which bruise easily should be picked in shallow baskets, holding about 10 lb. Care should be taken to see that the fruit spurs are not broken off at the time of picking.

The case which finds most favour with both growers and buyers is the 12-lb. case. At the time of packing, all stemless cherries should be rejected, and the top layer of fruit faced in rows with the stems hidden. This work can be done best by women and girls, who lay the cherries on the bottom of the box in rows, fruit side down; then fill the box, nail on the bottom, turn over and mark the faced side as top; or stencil the case so that the properly-faced side will be opened, which will show the cherries neatly rowed and presenting a very attractive appearance.

Diseases of the Cherry.

Cherry-tree Borer (*Cryptophæa unipunctata*, Don).—Treatment: When a tree is found to be attacked by these grubs, remove all the felted web, and insert a bit of copper-wire into the burrow so as to injure the grub; but, as this cannot always be managed, it is also advisable to squirt a little kerosene oil into the hole and then plug it up. Some growers have found that dipping a wooden plug in kerosene and then driving it into the hole killed the grub.

San José Scale.—Treatment: Spray with resin, caustic soda, and fish oil for summer; and lime, sulphur and salt solution for winter.

Rutherglen Bug.—As this bug spreads so easily, we have been unable to find anything to keep the trees free from them up to the present.

Pear Slug.—Treatment: Spray with Paris green—1 lb. to 200 gallons of water will poison the foliage, and not hurt the fruit. Dusting the foliage with lime is also good. Where they are found to be very destructive to the foliage, it would be advisable to disturb the soil round the trunks of the trees, or treat them with lime so as to destroy the cocoons in the ground.

Brown Rot.—Treatment: Spray with Bordeaux mixture when the buds are swelling; again spray when the fruit has set. Later on, when the fruit is well grown, spray with ammonio-carbonate of copper.

Powdery Mildew.—Spray with ammonio-carbonate of copper, or with Bordeaux mixture, using 1 oz. of copper sulphate to 12 gallons of water.

Gumming.—Gumming may result from excess of water or of drought in the soil, and is therefore not considered in itself a disease, but rather an indication of conditions unfavourable to the thrifty growth of the tree. It has been usually found by investigation that trees in perfect condition of health, with the moisture just enough and not excessive, are not troubled with gumming; but there are cases in which this statement does not wholly apply. There is very much in this connection which is not fully demonstrated as yet. Many treatments are proposed. It is a good thing to cleanly remove all the unhealthy bark, cutting clean to sound bark, and covering the wound with paint or wax to exclude the air. Some report success with an antiseptic wash. Diluted crude carbolic acid and the Bordeaux mixture have both been used and reported upon favourably. (Wickson.)

The following synopsis of cherries is taken from Dr. Hogg's "Fruit Manual":—

All the varieties of cultivated cherries will be found to consist of eight races, into which I have arranged them:—(1) The sweet, heart-shaped cherries with tender and dark-coloured flesh, I have called Black Geans. (2) The pale-coloured sweet cherries, with tender and translucent flesh and skin, I have distinguished by the name of Red Geans. (3) Dark-coloured sweet cherries, with somewhat of the Bigarreau character. Their flesh is not so firm and crackling as that of the Bigarreau, but considerably harder than in the Black Geans, and these I propose to call Black Hearts. (4) Includes the White Hearts or Bigarreaux, properly so-called, with red or light-coloured mottled skin and hard crackling flesh. (5) Those having a dark skin and flesh and deeply coloured juice are called Black Dukes. (6) Embraces all those nearly allied to the Black Dukes, but with pale red translucent skin and flesh and uncoloured juice; they are therefore distinguished as Red Dukes. (7) Includes all those the trees of which have long, slender, and pendant shoots and dark-coloured fruit, with acid, coloured juice, and are termed Black Morellos. (8) I have called Red Morellos; they include all those pale red, acid varieties of which the Kentish Cherry is the type.

I.—Geans.

Branches rigid and spreading, forming round-headed trees. Leaves long, waved on the margin, thin and flaccid and feebly supported on the footstalks. Flowers large and opening loosely; with thin, flimsy, obovate or roundish ovate petals. Fruit heart-shaped, or nearly so. Juice sweet.

Fruit obtuse, heart-shaped; flesh tender and melting: flesh dark, juice coloured—Black Geans.

Baumann's May	Guigne Très Précoce	Luke Ward's
Black Eagle	Hogg's Black Gean	Osceola
Early Lyons	Joc-o-sot	Waterloo
Early Purple Gean	Knight's Early Black	Werder's Early Black.
Early Rivers	Late Purple Gean	

Flesh pale, juice uncoloured—Red Geans.

Amber Gean	Early Amber	Manning's Mottled
American Doctor	Early Jaboulay	Ohio Beauty
Belle d'Orléans	Frogmore Early	Sparhawk's Honey
Delicate	Hogg's Red Gean	Transparent Gean.
Downer's Late		

Fruit heart-shaped; flesh half tender, firm, or crackling; flesh dark, juice coloured—Black Hearts.

Bedford Prolific	Bohemian Black Bigarreau	Ox Heart
Bigarreau de Mezel	Brant	Pontiac
Bigarreau Noir Hatif	Büttner's Black Heart	Powhattan
Bigarreau Noir de Schmidt	Corone	Rival
Black Hawk	Early Black Bigarreau	Tecumseh
Black Heart	Logan	Tradescant's Heart.
Black Tartarian	Monstrous Heart	

Flesh pale, juice uncoloured—Red Hearts or Bigarreaux.

Adam's Crown	Champagne	Kennicott
American Heart	Cleveland Bigarreau	Lady Southampton's
Belle Agathe	Downton	Late Bigarreau
Belle de Rocmont	Drogan's White Bigarreau	Ludwig's Bigarreau
Bigarreau	Drogan's Yellow Bigarreau	Mammoth
Bigarreau Esperen	Early Red Bigarreau	Mary
Bigarreau de Hildesheim	Gascoigne	Red Jacket
Bigarreau de Holland	Harrisons' Heart	Rockport Bigarreau
Bigarreau Jaboulay	Early Prolific	Tardive de Mans
Bigarreau Legrey	Elton	Tobacco-leaved
Bigarreau Napoleon	Florence	White Heart
Bigarreau Reverchon	Governor Wood	White Tartarian.
Bowyer's Early Heart		
Büttner's Yellow		

II.—Griottes.

Branches either upright, spreading, or more or less long, slender, and drooping. Leaves flat, dark green, glabrous underneath, and borne stiffly on the leaf stalks; large and broad in §, and small and narrow in §§. Flowers in penduneulate umbels, cup-shaped, with firm, stiff, and crumpled orbicular petals. Fruit round or oblate, sometimes, as in the Morello, inclining to heart-shaped. Juice sub-acid or acid.

§ Branches upright, occasionally spreading. Leaves large and broad.

Flesh dark; juice coloured—Black Dukes.

Archduke	Empress Eugénie	Nouvelle Royale
Büttner's October	Jeffrey's Duke	Royal Duke
Duchesse de Palluau	May Duke	De Soissons.

Flesh pale; juice uncoloured—Red Dukes.

Abesse d'Oignies	Coe's Late Carnation	Planchoury
Belle de Choisy	Dechenaut	Reine Hortense
Belle Magnifique	Great Cornelian	Tomato
Carnation	Late Duke	Transparent.

§§ Branches long, slender, and drooping. Leaves small and narrow.

Flesh dark; juice coloured—Black Morellos.

Double Natte	Griotte de Kleparow	Ratafia
Early May	Morello	Shannon Morello.
Griotte de Chaux	Morello de Charmeux	
Griotte Imperiale	Ostheim	

Flesh pale; juice uncoloured—Red Morellos or Kentish.

All Saints	Flemish	Kentish
Cluster	Gros Gobet	Paramdam.

In Wickson's third edition of "California Fruits," he says:—

In classification of cherries it was originally considered that there were four classes of cherries. The Hearts were the tender and half-tender sweet cherries, while the Bigarreaux were the firm-fleshed ones; but these have been so intermingled and blended together by hybridisation that no distinct line can now be drawn separating them. There is really but one class of these whose main characteristic is the large, vigorous growth of the tree. The Duke and Morello cherries, also wanting a natural division, really constitute but one class.

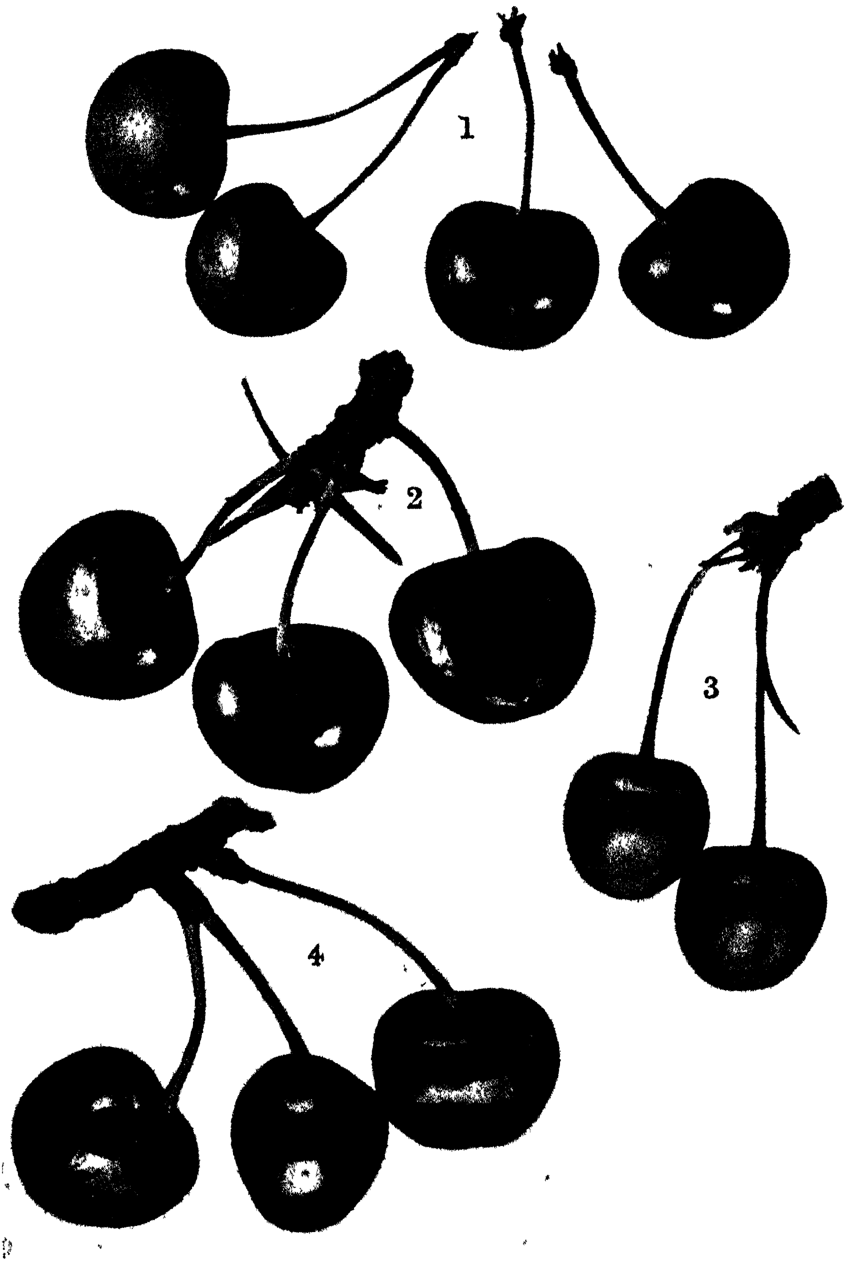
The Bigarreaux and Hearts he gives as follows:—

Early Lamaurie	Yellow Spanish	Knight's Early Black
Guigné Marbree	Pontiac	Coe's Transparent
Belle d'Orleans	Ox Heart	Black Tartarian
White Tartarian	Tradescant's Black Heart	Elton
Werder's Early Black		American Amber
Rockport Bigarreau	Baumann's May	Mezel, Montrueuse de
Cleveland Bigarreau	Early Purple Guigné	Burr's Seedling
Governor Wood	Early White Heart	Napoleon Bigarreau
Black Eagle	American Heart	Schmidt's Bigarreau.

Dukes and Morellos, as follows:—

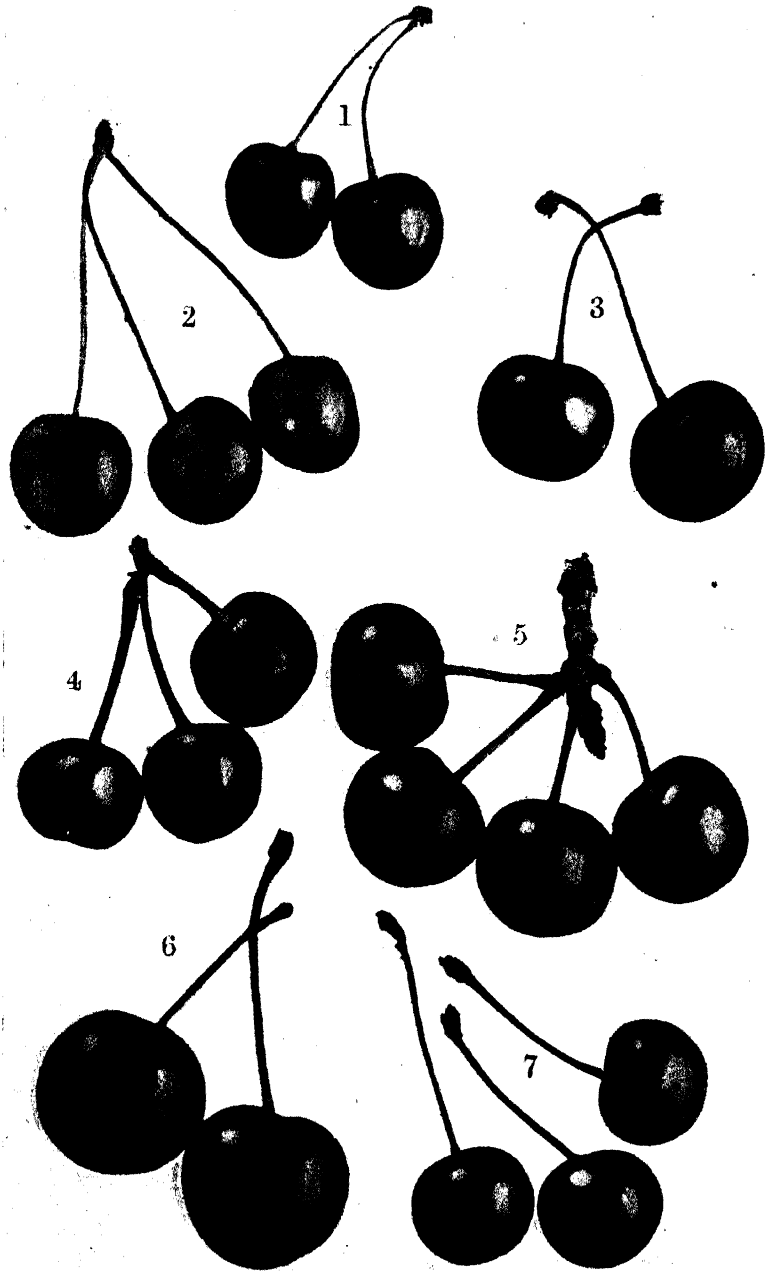
Early Richmond	Late Duke	Guigné Noir Luisante
May Duke	Reine Hortense	Belle Magnifique.
Arch Duke	English Morello	

The following is a list of cherries which I have had photographed, and which are growing at our Wagga and Bathurst orchards, the majority of those photographed having come from the former orchard. To a person not accustomed to seeing fruit photographed, it looks smaller than when looking at the actual fruit, and besides this the cherries grown at Wagga seldom if ever attain to the same size as where found in more favourable cherry-growing districts, such as Bathurst, Orange, Armidale, Goulburn, &c.



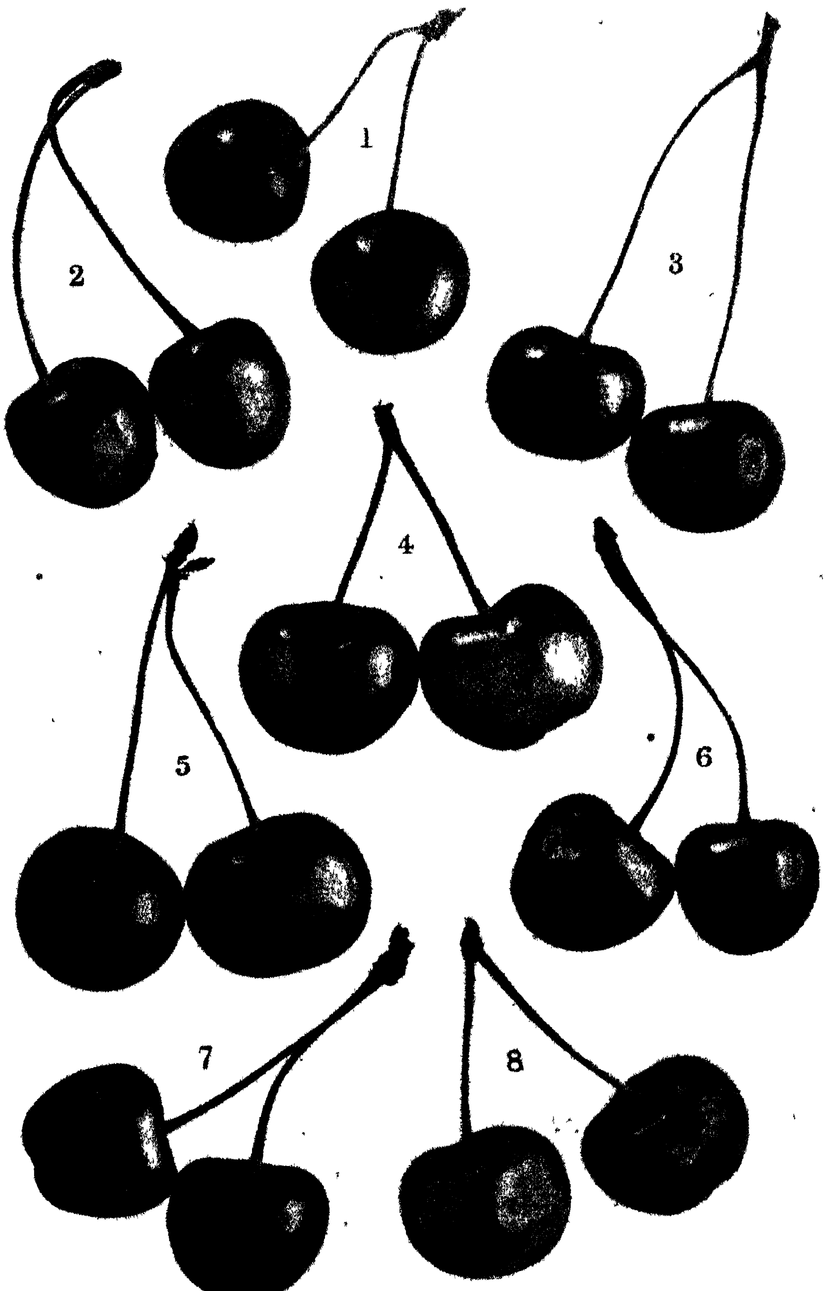
Cherries.

1. Scarlet Bigarreau.
2. Bigarreau Reverchon.
3. Elton.
4. Early Lyons.



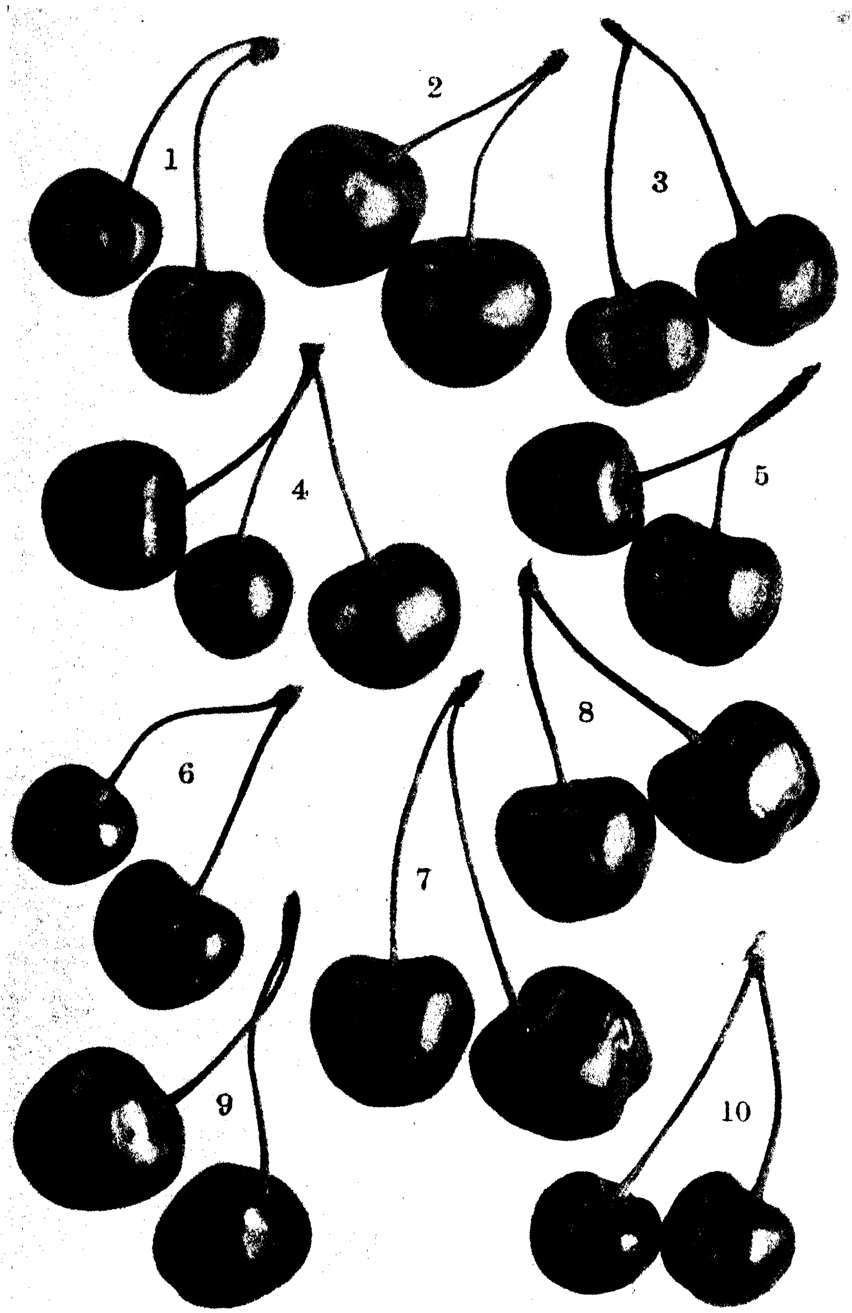
Cherries.

1. Williamette.
2. White French Guigne.
3. Olivet.
4. Donna Maria.
5. Montmorency.
6. Planchoury.
7. Early Richmond.



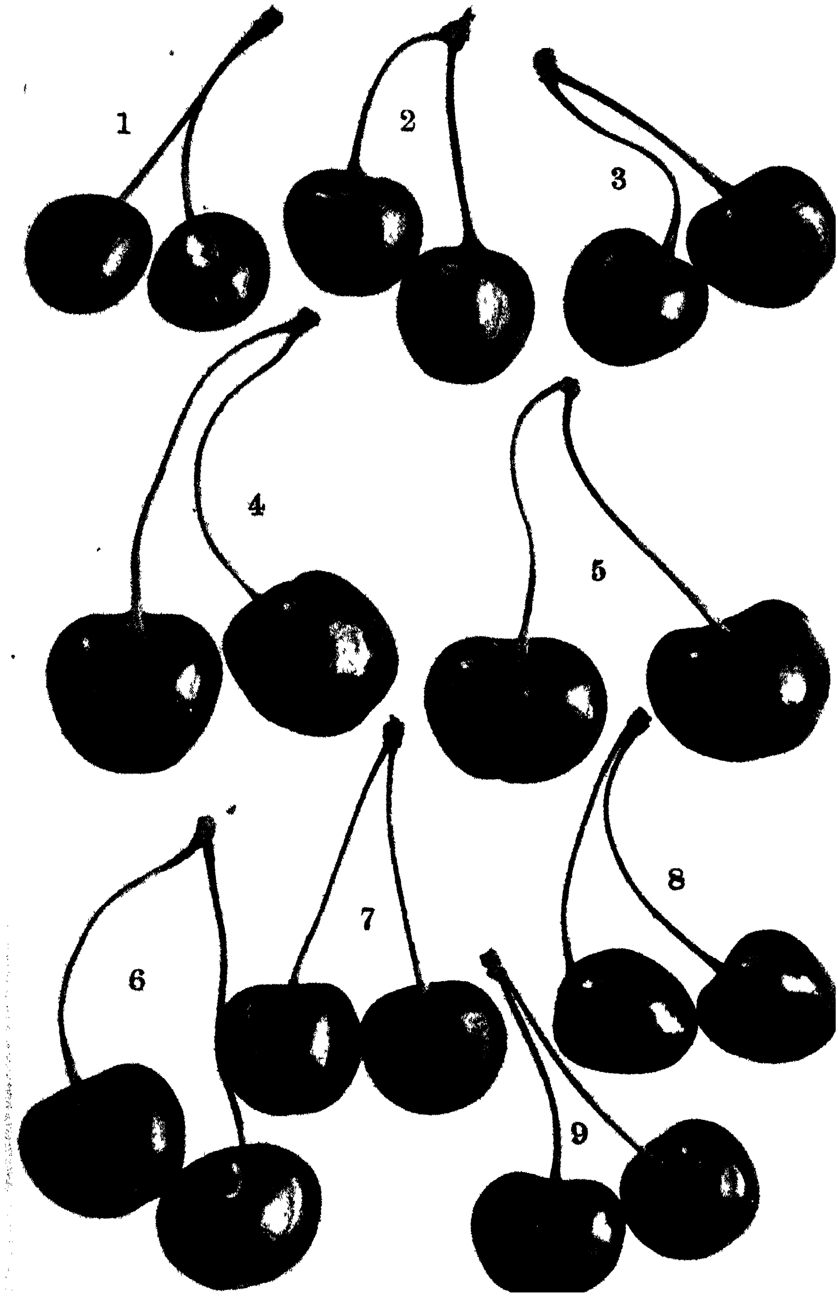
Cherries.

1. Yellow Spanish.
2. Early Red Guigne.
3. Belle de Choisy.
4. Centennial.
5. Reine Hortense.
6. River's Seedling.
7. Cleveland Bigarreau.
8. Chusty's Bigarreau.



Cherries.

1. Bigarreau Elizabeth.
2. Napoleon Bigarreau.
3. Ohio Beauty.
4. Schmidt's Bigarreau.
5. Windsor.
6. Black Eagle.
7. Black Bigarreau.
8. Black Republican.
9. Bigarreau de Mezel.
10. Goblin's Seedling.



Cherri

1. Black Tartarian
2. Holman's Duke
3. Black Hawk.
4. [illegible]
5. Bedford Prolific.
6. Pontiac.
7. Brant.
8. Knight's Early Bla

9. Tally

At the end of each of the descriptions given below will be found a letter to correspond with one of the six cherries shown in the coloured plate which has been reproduced from specimens grown in this State, and indicating as nearly as possible the natural colour of the cherry described.

Black Eagle.—Fruit dark red, medium sized. Flesh firm, dark red. Heavy crop of fruit, hanging in pairs and singly. Ripe 22nd November, at Wagga. Colour E.

Reine Hortense.—Fruit very large, light red. Flesh yellowish white, very soft and watery, of distinct Morello flavour. Ripens very unevenly, some small and green while others are dead ripe. Ripe 12th November at Wagga. Light crop, hanging singly. Colour C.

Knight's Early Black.—Fruit rounded, heart-shaped, medium size, almost black, rather soft. Flesh dark purple, of good flavour. Light crop, hanging in pairs. Ripe 12th November at Wagga. Colour F.

Black Hawk.—Fruit medium sized, dark red, almost black when dead ripe. Flesh firm, dark red. Heavy crop, hanging in pairs and threes. Tree only fairly vigorous. Ripe 16th November at Wagga. Colour F.

Pontiac.—Fruit medium sized, round, dark red. Flesh firm red. Heavy crop hanging in pairs. Ripe 14th November at Wagga. Colour F.

Bigarreau Cœuret.—Fruit very large, heart-shaped, dark red. Flesh very firm, pink, of good flavour. Medium crop, mostly hanging singly. Ripe 13th November at Wagga. Colour F.

Black Tartarian.—Fruit large, very dark, almost black. Flesh purple, juicy, and rich. Heavy cropper—one of the best varieties. Ripe 13th November at Wagga. Colour F.

Brant.—Fruit large, dark red. Flesh purple, fairly firm, good flavour. Heavy crop, hanging in pairs. Ripe 12th November at Wagga. Colour F.

Bedford Prolific.—Fruit large, roundish, heart-shaped, dark red. Flesh red, fairly firm. Good shipper—not showing bruises readily. Fair crop, hanging in pairs and clusters. Ripe 21st November. Colour F.

Tally-Ho.—Fruit small, heart-shaped, with pointed apex; almost black when dead ripe. Flesh firm, dark red. Useless as a market variety. Heavy crop, hanging singly—in pairs and threes. Ripe 18th November at Wagga. Colour F.

Montmorency.—Fruit medium, round, bright red. Flesh white, juicy, and soft, of the Morello type. An excellent jam and canning variety. One of the best sour cherries grown for these purposes. Tree slow but healthy grower. Very heavy crop, hanging singly and in pairs. Ripe 11th December at Wagga. Colour D—E.

Scarlet Bigarreau.—Fruit above medium size, rounded, heart-shaped, mottled with red on a yellow ground. Flesh rather firm, white. An attractive-looking cherry. Heavy crop, hanging in pairs and singly. Tree rather subject to gumming. Ripe 26th November at Wagga. Colour B.

Bigarreau Reverchon.—Fruit very large, heart-shaped, with pointed apex, dark red. Flesh dark red, firm, stalk short. Valuable market variety. Light crop, well distributed over the tree, hanging singly. Ripe 30th November at Wagga, 18th December at Bathurst. Colour E.

Bohemian Black Bigarreau.—Fruit very large, roundish, heart-shaped, dark red. Flesh red, fairly firm. Should be a valuable market variety. Medium crop, hanging singly and in pairs. Ripe 24th November at Wagga. Colour E.

Belle de Choisy.—Fruit medium sized, light red. Flesh soft, very juicy, distinct Morello flavour. Light crop, hanging singly. Ripe 16th November at Wagga. Colour E.

White French Guigne.—Fruit small, heart-shaped, very light amber colour or almost white. Flesh soft, juicy, white. Of little value as a market variety. Light crop, hanging in pairs and threes. Ripe 21st November at Wagga. Colour not indicated in plate.

Sparhawk's Honey.—Fruit medium, heart-shaped, light red. Flesh very juicy, soft, white, very sweet. Of little value as a market variety. Heavy crop, hanging singly and in pairs. Ripe 22nd November at Wagga. Colour D.

Olivet.—Medium, dark red, round. Flesh red, soft, very juicy, sour, Morello type. Good for canning and jam making. Medium crop, hanging singly. Ripe 25th November at Wagga. Colour D—E.

Williamette.—Fruit small, black, heart-shaped.—Flesh firm, purple. Too small for market purposes. Medium crop, hanging singly and in pairs. Ripe second week in November at Wagga. Colour F.

Planchoury.—Fruit medium size, round, red. Flesh yellowish, soft, of the Morello type. Crop light, hanging in pairs. Colour D.

Early Richmond.—Fruit rather small, becoming medium when well ripened, round, light red. Flesh very juicy and moderately rich. Good cooking variety. Colour D—E.

Cleveland Bigarreau.—Fruit medium sized, yellow, shaded with red. Flesh yellowish, fairly firm, fair flavour. Heavy crop, in clusters of twos and threes. Ripe 14th November at Wagga. Colour C.

Early Red Guigne.—Fruit medium sized, pointed, long shaped, light red. Flesh white, soft. Not suitable for market. Heavy crop, hanging mostly in pairs. Colour A.

Rivers' Seedling.—Fruit medium sized, pointed at apex, heart-shaped. red. Flesh firm, white. Light crop, hanging in clusters of twos and threes. Ripe 18th November at Wagga. Colour D.

Yellow Spanish.—Fruit medium sized, yellow, shaded with light red in the sun. Flesh yellowish white, fairly firm. Heavy crop, hanging singly and in pairs. Ripe 21st November at Wagga. Colour B.

Bigarreau de Mezel.—Fruit very large, dark red. Flesh firm, pinkish white, good flavour. Heavy crop, hanging mostly in pairs. Ripe 15th November at Wagga, 4th December at Bathurst. Colour E—F.

Ohio Beauty.—Fruit medium, light red. Flesh white and soft. Heavy crop, in clusters of threes. Ripe 22nd November at Wagga. Colour B.

Goblin's Seedling.—Fruit small, flat, heart-shaped, dark red. Flesh firm, purple, fair flavour. Heavy crop, mostly in clusters of threes. Ripe 13th November at Wagga. Colour E.

Windsor.—Fruit large, greyish red. Flesh firm, yellowish white. A good market variety. Heavy crop, hanging singly and in pairs. Ripe 27th November at Wagga. Colour D—E.

Donna Maria.—Fruit small, round, red. Flesh white, soft, juicy—of the Morello type. Medium crop, hanging singly and in pairs. Ripe 7th December at Wagga. Colour D—E.

Black Republican.—Fruit above medium, very regular, dark red. Flesh red, firm. Fair crop, hanging singly and in pairs. Ripe 20th November at Wagga. Colour E.

Christy's Bigarreau.—Fruit large, yellow, shaded with light red. Flesh white, fairly firm, fair flavour. Shows bruises badly. Very heavy crop, hanging mostly in pairs. Ripe 12th November at Wagga. Colour A—B.

Schmidt's Bigarreau.—Fruit medium sized, dark red. Flesh firm, pink. Medium crop, in pairs and threes. Ripe 20th November at Wagga. Colour E.

Centennial.—Medium to large, flat, heart-shaped. Yellow, mottled with red in the sun; very handsome. Flesh firm, white, good flavour. Good shipper. Fair crop at Wagga, heavy at Bathurst, hanging in clusters. Ripe 18th November at Wagga, 16th December at Bathurst. Colour B—C.

Florence.—Fruit large, firm, whitish, partly mottled—covered with two shades of red. Flesh light, very firm, juicy, sweet. Good keeper, carries well, and hangs a long time. Heavy cropper. Ripe 7th December at Wagga, 26th December at Bathurst. Colour A.

Early Lyons.—Fruit very large, heart-shaped, dark red, becoming very dark when fully ripe. Good flavour, slightly acid. Does not show bruises. Heavy crop of even-sized fruit, hanging singly and in pairs. Ripe 9th November at Wagga. One of the best early varieties. Colour E.

St. Margaret.—Fruit very large, rounded, heart-shaped, dark red colour, almost black. Flesh firm, red, sweet. Medium crop, hanging singly and in pairs. Ripe 9th December at Wagga, 27th December at Bathurst. Colour E.

Bigarreau de Hollande.—Fruit large, regular, heart-shaped, inclining to oblong. Skin amber in the shade, dotted with red, with a fine crimson cheek. Flesh yellowish white, sweet, firm, juicy, and a high flavour. Ripe 25th December at Bathurst. Colour E.

Rockport Bigarreau.—Fruit medium to large, long, heart-shaped—yellow and light red on sunny side. Flesh yellow, firm, fair flavour. Heavy crop, hanging in twos and threes. Shows bruises somewhat. Ripe 12th November at Wagga, 26th November at Bathurst. Colour B.

Napoleon Bigarreau.—Fruit very large, yellow, shaded with red in the sun. Flesh firm, white. Shows bruises. Very heavy crop, hanging mostly in pairs. The favourite variety for canning in California, where it is also known as the Royal Ann. Ripe 21st November at Wagga, and 12th December at Bathurst. Colour B.

Twyford Bigarreau.—Fruit large, heart-shaped, medium to large, light red on a yellow ground. Flesh soft, white; shows bruises easily. Heavy crop, in clusters of twos and threes. Ripe 12th November at Wagga. Colour B—C.

Markets for Preserved and Fresh Fruits.

Mr. Walter W. Griffin, the United States Commercial Agent, reports that while foreign canned and dried fruits were scarcely known in France a few years ago, to-day there is hardly a grocery of any importance in any French town but has American dried fruits on its shelves. Already complaints are heard in France about the inroads made on the home trade by these foreign fruits, but careful investigation shows that the sales of French goods are practically the same as they were before the advent of the Americans in this market. French taste is changing; far more people use dried and canned fruits now than ten years ago. The prices of these so-called luxuries have been greatly reduced so as to bring them within the reach of classes that could not enjoy them before introduction of the foreign products. The French markets are beginning to abound in fruits that formerly were unseen, or very rarely seen. Bananas and pineapples are no rarity now; nearly every fruit store sells them. Bananas shipped from the West Indies are on sale in Paris and other large cities. The time is not far distant when the fresh fruits of Florida and California will be as common in French cities as they are now in New York.

Considering the high quality of New South Wales dried and canned fruits, there should also be a fair chance in such markets for some of our products.

Weeds of New South Wales.

THE COW-COCKLE (*Saponaria vaccaria*, Linn).

BY J. H. MAIDEN,
Government Botanist and Director of the Botanic Gardens, Sydney.

Botanical name.—*Saponaria,* from the Latin *sapo*, soap, the leaves of some of the species containing a saponifying principle; *Vaccaria* Latin *vacca,* a cow. I am not clear as to the connection, real or supposed, of cows with this plant. In Britain and North America it goes under the names of Cockle, Cow-Cockle, China-Cockle, and Cow-herb.

Botanical description.—It belongs to the Caryophyllaceæ or Pink family. It is an erect annual, about 2 feet high, perfectly smooth, without any hairs, and of a rather pale-green colour. Leaves opposite, lanceolate, about 3 inches long, sessile with a broad base, and the opposite pairs are united at the base. The flowers, which are terminal in a loose bunch on long stalks, are pink, about ¾-inch in diameter, but the size of the flower varies considerably. Calyx 5-angled, shortly 5-lobed at the top, much enlarged after flowering. Petals 5, emarginate at the top. The plant is best distinguished by the five very prominent angles of the calyx. Seeds spherical, tuberculate, black when fully ripe.

Fodder or other uses.—I cannot find that, except by accident, stock eat this plant at any time, and hence it lives its life unchecked unless man takes it in hand. In India, that country in which a surprising amount of information has been gathered together in regard to the uses and drawbacks of the native vegetation, some notes are available in regard to this plant also, and I extract some of them from the *Dictionary of Economic Plants of India* (Watt).

I may say I have not heard of it being suspected as a poison plant in this State.

The properties of this plant are stated to be in every respect identical with those of *S. officinalis,* the soap-wort (O'Shaughnessy). It is considered by the natives of India to have febrifugic and tonic properties in long continued fevers of a low type (S. Arjun). The mucilaginous sap is said to be an efficacious remedy for itch (Murray). Preparations of this plant have emulsifying properties on account of the saponin it contains. It does not appear generally to have assigned to it the saponaceous properties which its congener enjoys, but Murray mentions that in Sina the mucilaginous sap is used by the natives in place of soap for washing clothes. The writer of the dictionary recently questioned the cultivators in the Dhami State Simla, as to the properties of the *Saponaria* which was found as a


A
B
C
D
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F

troublesome weed in their wheat-fields. They said that it often proved poisonous to young cattle, but that older animals would not eat it. They were ignorant of its saponaceous properties.

How to get rid of it.—Prevention is better than cure and it is best to buy clean wheat. The up-to-date farmer will screen his own wheat wherever the seed-wheat comes from, and carefully burn any suspected screenings. And if it should unfortunately make its appearance it should be hoed out or hand-pulled before it seeds. The road sides and the fences should also be carefully watched. I make no recommendation in regard to many weeds, but it is competent for any farmer to eradicate this particular pest unless he systematically neglects it for a year or two.

Following is what some American farmers say of it :—"This is at present the worst weed in grain fields. Springing up with the wheat the latter is crowded out, shaded out, and robbed of the food it might otherwise get from the soil. A field well seeded to cockle as well as wheat, is practically beyond redemption."

Where Found.—It is a native of Europe, Asia Minor, India, Thibet, Siberia, &c., but not England, though found there in corn-fields. It has been tolerated as a pretty plant, and is, indeed, cultivated in gardens, and that is the danger of it. If it were ugly (if there be such a thing as an ugly plant) every man's hand would be against it. I do not remember that this plant has been recorded as found in New South Wales until I drew attention to it last year in a note published in the *Journal Royal Society, N.S.W.* During 1903 it sprang into unenviable notoriety, for it and the Cape-weed (*Cryptostemma*) were the two weeds most frequently sent in by farmers as new to them. It came from scores of localities in all parts of the State, except the hottest parts. I have no doubt that in the great majority of cases it came with seed-wheat, since, after the break-up of the drought, farmers often brought wheat that contained the seeds of various weeds. This wheat came from North and South America, New Zealand, and other places.

EXPLANATION OF PLATE.

Saponaria vaccaria, Linn.

A. Entire plant, half natural size.

B. Inflated calyx and seeds (the capsule concealed in the calyx), natural size.

C. Flower, the calyx opened, 2½ times natural size.

D. Petal and two stamens, 2½ times natural size.

E. Ovarium with styles (or stigmatic branches), 5½ times natural size.

F. Seeds, 7 times natural size.

Forestry.

A Plea for the Western Pine.

P. J. HOLDSWORTH.

THAT the western pine has been ruthlessly destroyed is well known. The first thought of the agriculturist settler in the west is to get the timber off the land. Ringbark it; cut it down; burn it out. Do anything with it, only get rid of it. The thought which dominates all others is how he may exterminate the timber. Actuated by a desire for more grass, for more grass means more stock, the sheep farmer is again at work with the axe. This time on the bark only. The result is that where stood 100, 200, or 1,000 acres of magnificent pine forest, there stands a year or two afterwards only skeletons bleaching in the blazing western sun. The creeks and water-holes, which had always been looked upon as permanent, dry up, and then this curious phenomenon of nature is regarded with amazement. He does not realise that it is the inevitable consequence of denuding the land of its timber cover.

Apropos. Mr. Consul H. D. Barnum, in his report presented to the British Parliament in May, 1903, says: "The physical aspect of Northern Syria, as well as its climate, has no doubt greatly changed within modern times through the destruction of the forests. A spur of the Amanus strikes east towards Aleppo, and every here and there its crest is crowned with pine. Those hills were once covered with dense forests, which so far affected the climate that burning summer heat was then tempered by frequent rains."

Mr. Consul W. S. Richards, in his report, presented in the same year, in speaking of the destruction of the forests in the consular district of Beirout, says: "In the Vilayet of Beirout, the pine forests which existed thirty or forty years ago are rapidly disappearing; the effect on climate and rainfall is already felt, and the mountains, in all probability, will be left quite bare." Again, in speaking of another district where some movement towards reafforestation was afoot, he says: "If the increase continues it will benefit the country greatly, as the woodlands will retain much of the rain water which now runs rapidly down the steep slopes, and thus, in time, the rainfall should become more even."

Cases innumerable might be cited as illustrating how thoroughly the influence of vegetation upon climate is now recognised. But the above have been selected for the following reasons:—Physically, Syria offers

remarkable close parallels to New South Wales. The districts referred to in the above reports lie as far north of the equator as a considerable part of New South Wales does south, that is, between the parallels of 32 degrees and 38 degrees, thus corresponding as to degrees with, say, the Manning River to Cape Howe. There is a west wind laden with moisture blowing off the Mediterranean, which corresponds to our north-east wind. There is a sea slope of from 30 to 50 miles in width, backed by the Lebanon mountains; and this sea-board, getting most of the rains, is correspondingly fertile. The annual mean temperature of Beirout is 68 degrees, and lastly, the occasional ozoneless east wind (the sirocco) parches up vegetation in much the same manner as our "westerly." So that altogether the climate would seem to present a near approach to our own. Although there are, so far as I can ascertain, no accurate meteorological observations, I think it may be safely assumed that Damascus can give no points to many of our inland towns as regards summer heat.

If the reasons given above are allowed to be a sufficient warrant for comparing the two countries, then it may not be unreasonable to expect that the effect of the denudation of our forests will be followed by results of a similar nature to those which have been experienced in Syria. . . .

Curiously enough, this total destruction of the timber here in the West defeats its own end. For, all shade and shelter of every description having been removed, evaporation now takes place at such a rapid rate that every last drop of moisture is extracted from the soil. Hardly is even the night's dew deposited before it has again disappeared. Nature, when abused, is indeed a Shylock, and no Portia may step in here to save Antonio.

Grass does best while the timber is *actually* dying, and before all the shade and moisture are gone. Judicious thinning, instead of total destruction, would then probably better meet the case, and, moreover, the settler who so decided would have a valuable standing asset in the timber.

Destruction of the pine is a short-sighted policy for the individual; but for the community as a whole it is disastrous; for reafforestation of our western country will prove by no means an easy task. Let anyone who doubts the truth of this statement endeavour to transplant a western pine in a sun-baked, open plain, and learn the truth of this. Nature, undisturbed, will see to it that the pine is perpetuated. She has done so for hundreds of years, and only asks for fair treatment. But once destroy her product—once wipe it out, and leave the country bare—and Dame Nature will exact her pound of flesh.

We hold in fee-simple a great asset. How great it is is persistently impressed upon the man whose duty takes him daily into the forest—the man who is the hewer of the wood and the drawer of the water. He it is who, seeing these things, is in duty bound to speak—even though his voice may be, in more senses than one, "a voice of one crying in the wilderness."

Some Practical Notes on Forestry suitable for New South Wales.

By J. H. MAIDEN,
Government Botanist and Director, Botanic Gardens, Sydney.

II.

Sowing the Seed.

Seed can be broad-casted, or it can be planted in prepared ground in the forest. But it is usually most economical to propagate forest trees in nurseries, and thence to plant out the seedlings at the proper time. In some moist localities, where it is desired to establish a tree growth on grass land, it has been recommended to sow on the thick inverted sod. The top of the sod is usually free from seeds of any kind which would compete with the tree seedling.

The treatment of some tree-seeds can only be learnt by practice. Palm seeds may be six months germinating, and other seeds are so dilatory that they are often thrown out as worthless when such is not the case. The following method of treating Indian Teak seed applies also to those of our White Beech (*Gmelina Leichhardtii*) and of some other difficultly germinable seeds :—" Teak seed, if collected and sown immediately, will generally take a year or two to germinate; but if a pit be dug, and the bottom filled to a foot deep with sand, the seed spread thickly on this (2 in. to 6 in.), and covered with another foot of sand, and the whole mass well watered, it will be found, on opening it at the expiration of three or four weeks, that germination has already commenced. If it now be taken out and sown, it will spring up almost immediately, provided it be kept well watered."*

The Bamboo Method of Tree-raising.

The history of the bamboo method of tree-raising, largely used in India, and successful in every State of the Australian Commonwealth, has been told by the late J. Ednie Brown in his "Tree Culture," is interesting, and is not generally known. "In the Forest Department of India, a system of rearing young plants in short pieces of bamboo cane was introduced a good many years ago by a Captain Beddome, one of the conservators of forests there. This was found to be admirably suited for the purpose, and is thus briefly described in the *Journal of Forestry* for July, 1880 :—" Cut the bamboo of which estate baskets are made, and which is not more than an inch or two in circumference, into bits about 3 inches long. Place these pieces endways close together, in thousands, cover with forest mould or fine soil and sow your seed. In this way there will be from one to three or four seedlings in each piece of bamboo. When carried out in the bamboo the best plant can be left, the others being removed and utilised immediately or at a subsequent period."

* Amery. "Notes on Forestry," p. 20.

"When the subject of forest conservancy was first mooted in this Colony, His Excellency Sir Anthony Musgrave, the then Governor of South Australia, in a lecture on the subject, incidentally referred to Captain Beddome's system, which he had heard of or seen carried into effect in India. The idea of trying to adopt the method of tree-planting here was not, so far as I am aware, suggested at the meeting in question, simply, I would suppose, from the want of bamboos wherewith to carry it into effect. The idea, however, occurred to Mr. Murray, who was subsequently appointed as Conservator to the Forest Board of South Australia, that the same results might be obtained by the use of small pieces of the well-known reed, *Arundo donax*. Acting upon this notion, he had several pieces prepared, filled with fine soil, gum seeds sown in them; and the result was such that, on his appointment to the Forest Board, he suggested that he might be allowed to apply the system to the planting of the Bundaleer reserve, where the Board had just commenced operations. This the Board allowed, and, under the immediate supervision of Mr. John Curnow, nurseryman, the system has been carried out at Bundaleer with a certain degree of success in the raising and planting of *Eucalyptus* plants. With pines it has proved a failure."

The "bamboo" chosen is the common Danubian reed (*Arundo donax*), which flourishes in many parts of the State in muddy situations or by the sides of lagoons. The stems are cut by means of a treadle-saw and a gauge to a uniform length of about 5 inches. It is a matter of considerable practical importance to secure uniformity of length and to see that they are cut absolutely at right angles to the axis. The properly prepared fine soil is put into a stack of tubes standing on end and placed close to each other. It is necessary that the soil should completely fill each tube, and this is secured by tapping the tubes from time to time by means of a wooden beater. A little seed is placed in each tube, and the tubes are watered. The tubes are stacked in boxes, moderately tightly, so that they will remain vertical, but not too tightly, because expansion takes place, seeing that the tubes are kept wet. And here it may be mentioned that it is of practical importance to see that the bamboos are not too thick or tough. The bamboo tube is really a flower-pot, but with this difference: that tube and all are planted, so that if the tube will not readily decay in the ground the tender plant becomes pot-bound, or rather tube-bound, and will die or be retarded in growth. It requires judgment to select the tubes, and some growers half rot their tubes before putting seed in them, and sometimes they slit the bamboo or cut away the septum (partition of bamboo). Suppose the little trees to have been successfully grown, they are taken to the place of planting in boxes of a convenient shape.

The method of planting will depend upon circumstances. In operations on the forestry scale, two or more men are employed, a slit is made in the ground by means of a spade, another man comes along and drops in a bamboo-tube with its plant and fixes the earth with his feet, or this is done by a third workman. It is very important to plant the tubes vertically, and to let the top of each be just below the

surface. A farmer or other planter who wishes to put in only a few trees, may insert them with the trowel if the soil is sufficiently open. It is obvious that any man of common-sense will, according to his local circumstances, devise labour-saving methods for planting the trees thoroughly and cheaply, for forestry operations, to be successful, must have the cost of tree-planting cut down to the absolute minimum. I am not in favour of tree-planting by contract, except with a well-tried gang of men.

Mr. Walter Gill, the Conservator of Forests of South Australia, has an excellent illustrated article on the subject in the *Gazette* for December, 1900, p. 1130.

Tins in lieu of pots.—In country districts, and particularly in the far west, neither flower-pots nor bamboo-tubes may be available, and yet it may be desired to raise a small stock of trees. In every place tins, *e.g.*, jam tins, accumulate, often so much as to be a nuisance. These tins may be thrown aside till they are thoroughly rusted, and then used as pots for the reception of seeds. Their ragged edges and vertical sides prevent their contents being removed with facility as is the case with a flower-pot, but they can be buried with the plant, just as is the case with the bamboo-tube. If the tins be judiciously rusted, it will be found that when submerged in moist soil they do not long hang together, and the young tree pushes forth its roots through the holes which have rusted in various parts of the tin.

ALCOHOL FROM SAWDUST.

THE following is extracted from the January (1904) issue of the *Indian Forester*:—"At the recent Congress of Applied Chemistry, held in Berlin, Simonson, of Christiana, described a method of utilising saw-dust in the production of alcohol. About 2 tons of sawdust are boiled with sulphuric acid for three hours, the liquid matter being then extracted by pressure, neutralised, left to stand for eighteen hours to cool and clarify, and then fermented for four or five days. The resulting alcohol is afterwards distilled and rectified; and, making ample allowance for loss in the latter operation, the yield of spirit is said to be about 2½ quarts per cwt. of sawdust. Tests made with the method on a manufacturing scale are claimed to have demonstrated the possibility of working at a profit, and of opening up a new industry in timber-producing countries, where enormous quantities of sawdust are annually wasted."

[EDITORIAL NOTE.—It is most probable that Simonson's experiments were conducted with sawdust from soft woods, but the subject of similarly testing sawdust from our hardwoods is well worthy of the attention of local chemists. It is possible that some of the refuse from our timbers will be found capable of yielding products of value in addition to alcohol.]

A Sketch of the Position of Viticulture in Europe with respect to Phylloxera.

M. BLUNNO.

Remarks on some Experimental Phylloxera Legislation passed in Italy.

After my tour in Sicily I went back to Italy, and remained there two months, and visited many places, but concerned myself principally with viticultural subjects other than phylloxera and phylloxera-resistant vines, except such as the visit to the vineyard and nursery of resistant stocks at Velletri, the free international traffic of table grapes according to the International Convention of Berne, the experiments of Signor Danesi on the disinfection of vine-cuttings, vine

Wine Grapes at Howlong Viticultural Station.
Verdot on *Rupestris du Lot.*
Grafted in 1900.

rootlings, and fruit trees, to which I have already referred in the foregoing. I also made inquiries on the working of a new law passed three years ago, whereby twenty-four *Consorzi Anti-fillosserici* have

been created in the provinces of Lecce, Bari, Foggia (Apulia), in order to organise a service of supervision and popularise the knowledge on all matters connected with phylloxera and the reconstruction of vineyards on resistant stocks.

The wine output in Sicily has been greatly reduced. Apulia is at present the region in Italy that produces the greatest amount of wine in relation to its area. The country is dotted all over with fine large wineries, the biggest being that of Signor Pavoncelli, at Cerignola, with a yearly yield of over 2¼ millions of gallons. Unfortunately, phylloxera made its appearance in the province of Bari about four years ago. The extinction system was soon adopted with great stringency; but, at the same time, the Government, preparing for the worst, scattered through the three provinces the twenty-four abovenamed institutions. The law provides for the raising of portion of the funds by special taxation of the vignerons according to acreage, for the appointment of a committee elected by the vine-growers themselves, of which committee a resident viticultural expert appointed by the Government is a member. The committee administer the funds, which are wholly devoted for the supervision of vineyards, for the establishment and working of experimental vineries and nurseries of phylloxera-resistant stocks, for the distribution of cuttings, for lectures, &c. The expert is responsible to a chief commissioner, who resides in Bari; but, at the same time, he must work in harmony with the vine-grower members of the committee, who in some cases are apt to take an altogether different view from him on a subject strictly technical. Also, he has dealings with the mayors and town clerks of the municipalities within the *Consorzio* on such questions as preparing rolls, collecting taxes, obtaining clerical assistance, and other minor details, all of which concur to tax the energy and tact of the expert, who is to a certain extent bound to run with the hare and hunt with the hounds. These *Consorzi*, however, have not received a trial long enough to enable one to say whether they answer the purpose or not; but I fear that they will fail in becoming the centre of strenuous work and of intelligent propaganda, for which this special law was enacted. The phylloxera service in Italy is generally under the sole control of the Government. Thus unity and continuity of action emanates from a central authority responsible for the service as national policy, and its principal instructions are conveyed to the delegations in the different parts of the State. This system has given excellent results, in so far as it has succeeded in staying a sudden general spreading of phylloxera, and in vulgarising a budget of information on the resistant vines, and I fail to see what more this new law, passed for a region only of the State, proposes to attain.

I have no doubt that some of the twenty-four *Consorzi* will do a great deal, perhaps even more than the Government itself, as the sole authority, would do. These will be the *Consorzi* with committees composed of intelligent growers, enthusiasts, enlightened, active, and not self-seeking; but there will be districts where the Government official will have to contend with laggard and apathetic members, imbued with strange theories and fads.

Phylloxera-Resistant Stocks in France.

In my visit through Sicily, I had as companions several experts from the different vine-growing countries of Europe who had taken part in the International Congress of Agriculture and Viticulture in Rome. I will just mention among the best known Herr Portéle, Director of Agriculture, Vienna, Professor G. Foëx, late Principal of the Viticultural College of Montpellier, Monsieur Couderc, the eminent French *hybrideur*, Monsieur Guillon, Director of the Station Viticole of Cognac, Monsieur Besson, of Marseilles, proprietor of a large vineyard and nurseries of resistant stocks, of whom the firm Vilmorin, Andrieux of Paris obtained all the cuttings of phylloxera resistant stocks that this Department imported from France, and with which the first start was made, that ultimately led to the establishment of the State Viticultural Station of Howlong.

Naturally many views were exchanged on the all-absorbing subject, results were compared as obtained in the different countries, and in districts of the same country, thus I collected much information, which also helped me to make a final selection of the places that I would visit, and to better utilise my time, of which I had relatively little.

It was my intention on reaching Lyon to proceed to Villefranche sur Rhône, and visit the establishment for vineyard implements and

Wine Grapes at Howlong Viticultural Station.
Verdelho on *Riparia* X *Rupestris 3306*.
Grafted in 1900.

cellar appliances of Messrs. Vermorel, only 34 kilometers distant, to get letters of introduction from this firm, and from there make an excursion in the Beaujaulais. However, the elements were against me—heavy and continuous rain had started to fall since the previous

night—and I considered that the visit to the Beaujaulais vineyards was well nigh impossible. Thus, with regard to collecting information on the reconstruction of that district, I had to be satisfied with what I could gather in conversation with the members of the above-

Wine Grapes at Howlong Viticultural Station.
Muscat de Frontignac on *Riparia* X *Rupestris 3309*.
Grafted in 1900.

mentioned International Congress hailing from there, and I am enabled to report that the reconstruction of the vineyards in the Beaujaulais has not undergone much change lately. In fact, the stock *Vialla,* which is a hybrid of *Isabella* and *Clinton,* is as popular now with the local vignerons as it was in the early days of the replanting on resistant vines in that district. The *Vialla* stock has a low degree of resistance in the scale, the maximum degree of which is 20, but it suits so well in that region with a soil of granite origin, which therefore contains a good deal of sand, and besides is deep and with moisture never lacking, that Phylloxera causes no trouble to that stock. The *Riparia,* the *York-Madeira,* and the *Solonis* come next in the favour of those growers, and recently the following stocks were introduced to meet the requirements of compact or limestone soils which occur in places, viz., *Aramon* x *Rupestris Ganzin No.* 1, *Rupestris du Lot, Riparia* x *Rupestris* 3309, *Mourvedre x Rupestris* 1202.

The *Riparia* has a much higher resistance to Phylloxera than the *Vialla,* and both are eminently suited to the predominating type of soil of the Beaujaulais, yet the former stock occupies a secondary place in the reconstruction of the vineyards there, and the reason is, that the *Vialla* has a very great affinity with the *Gamais* which is the

principal variety of grape grown for the Beaujaulais wines, while the *Riparia* has less affinity for it. As the difference in affinity ultimately resolves itself in difference of output of wine, it is easily understood why a less resistant stock is preferred to one of the most resistant to Phylloxera. This is also another proof that a stock of limited resistance to Phylloxera becomes sufficiently resistant when planted in an eminently suitable ground, and is grafted with an European variety with which it has great affinity.

From Lyon I made for Bordeaux, *via* St. Germain des Fossés, Limoges, Libourne, which is the express route. Between Lyon and La Palisse the country is one of the richest; the train runs through intensely cultivated undulating flats, where evidently wheat-growing is the principal agricultural industry.

Wine Grapes at Howlong Viticultural Station.
Hermitage on *Riparia* × *Rupestris 3309*.
Grafted in 1900.

When the district of Allier is reached the traveller will notice at once that the country around is not so fertile; here are the celebrated Vichy Springs, whereat I put in a Sunday, starting for Bordeaux next morning. The district of Creuse is not interesting, but poor in contrast with the adjoining Limousin, which is thick with forests of oak. This oak is principally sought by the Bordeaux and Cognac merchants for casks for their wines and brandies.

After remaining at Perigueux for the night, a town famous as the emporium of French truffles, so plentiful in the Perigordin, I made the last stage of the journey to Bordeaux, this Holy of Holies of excellent wines. Of these I will speak in a separate article; here I shall refer

only to viticultural subjects proper, and inform my readers about the new conditions created in the viticultural industry by the Phylloxera invasion of the Gironde district.

The reconstruction on phylloxera-resistant stocks of the vineyards of the district of Bordeaux was started long ago, that country having been one of the first to be invaded by the parasite. No difficulty was experienced there, in so far as the soil is not refractory to the resistant vines as is the case in the Charente principally. Of course mistakes were made at the beginning when little was known of the actual degree of resistance of the various stocks. Then almost any American vine was planted, and some vignerons thought it should defy the attacks of phylloxera only because it was of American origin. Such vignerons soon paid the penalty of their inexperience, as they had to do the work of replanting over again, with a considerable loss of time, labour, and money.

The mainstay of the reconstructed vineyards in the Gironde is the *Riparia*, which, as a matter of fact, is the stock predominating in France; next come the *Rupestris*, and the *Riparia* x *Rupestris* hybrids. At present the Franco x American hybrids are meeting with great favour, many doubts as to the real resistance of the latter having been dispelled in the majority of cases.

Resistant stocks and the quality of wine.

When I strongly advocated the importation of resistant vines in Australia to be used as stocks the same bogey cry was raised from several quarters as happened in Europe, viz., that the varieties grafted on them would not produce a crop of the same standard quality as that obtained from the non-grafted vines. The short-lived agitation in Australia was disinterested; but in Europe at one time the campaign against resistant stocks was supported by self-seeking persons who had interests at stake as purveyors of bi-sulphide of carbon, injectors, &c., which were necessary to keep the phylloxera-infested vineyards alive by the application of so-called curative doses of carbon bi-sulphide every year.

A couple of years ago a report of the British Consul at Bordeaux was transmitted to the local authorities in Australia by the Agent-General in London, and got in the press. The report embodied the views of a wine-grower near Bordeaux—Monsieur Bellot des Miniéres—who contended that the quality of Bordeaux wines had already been affected through the alleged pernicious system of grafting the French varieties of grapes on phylloxera-resistant stocks. The report coming from no less an official authority than his Majesty's Consul at Bordeaux, purporting the views of a large wine-grower in the Bordeaux district, could not fail to create an impression. I know how difficult it is to get vignerons to set aside prejudices and old routine even in the face of imminent danger and actual losses, which often end in a total abdication of the viticultural industry rather than pulling together their energies and moving along the new road which is opened to them.

As we are just at the inception of the reconstruction of the vineyards of this State, and the Department had undergone expense and done important work at the newly-established State Viticultural Station of Howlong—between Corowa and Albury—where resistent stocks are

Wine Grapes at Howlong Viticultural Station.
Verdelho on *Riparia Gloire de Montpellier.*
Grafted in 1900.

propagated for distribution among the vine-growers of the State, I did not welcome the alarming report of Monsieur Bellot des Miniéres. When I visited the vineyard of Monsieur Ballande, just outside Bordeaux, in company of M. Audebert, an expert in the employ of that well-known commercial firm, I was but a mile from the vineyard of the self-appointed saviour of the reputation of good wines, and whose voice in any case, if it is not solitary, is only in unison with that of a few crazy impenitents. I had made up my mind to submit myself to the infliction of a sermon, and when I ventured to express my wish to my courteous guide that he might come with me and introduce me to the gentleman, he said he would if I cared, and smiled significantly. Recalling to my mind the report of Monsieur Bellot in which he does not consider the grafting on resistant stocks as solely responsible for the alleged falling-off of the quality of the French wines, but accuses with it with equal bitterness the employment of Bordeaux mixture, used as fungicide, I judged that I was going to meet a radical reformer, and that, as the reasons for the alleged lower standard, were twofold, it would have been hard indeed to establish how far the phylloxera-resistant stocks were responsible for it, and for how much the Bordeaux mixture was to account. Strange to say, the gentleman in

question deprecating this mixture, such as prepared on the generally accepted formula, recommended another as a substitute equally based on a copper compound as its principal agent. The "*ammoniures*" of copper, according to M. Bellot, is the active fungicide of his mixture, which would not be pernicious to the quality of wine as the hydro-oxide of copper formed in the Bordeaux mixture of the present formula.

The effects of Bordeaux mixture on the wine have been thoroughly studied long ago, when the *Plasmopara viticola* began to decimate the grape crop in Europe. Conclusive experiments have been carried out which have never been challenged, and it seems to me idle to further speculate on a subject that has long received its quietus by the scientific researches of the most competent authorities.

After all, it did not matter much to me to know what Monsieur Bellot des Miniéres thought of his theories; but it was more important to know what Government experts, as well as professional viticulturists and persons in charge of large viticultural establishments, thought of them. Thus, instead of going to see him, I mentioned the matter to qualified gentlemen whom I met afterwards. Evidently those theories must have been propounded with the vigour and zeal of an apostle,

Wine Grapes at Howlong Viticultural Station. Lambrusquat on
Riparia Gloire de Montpellier.
Grafted in 1900.

because everybody seemed to know of M. Bellot, and everybody answered my inquiry with the same significant broad smile, until, weary and feeling humiliated at being thought an innocent abroad, I allowed the matter to drop.

In the Médoc I visited the principal famous *crûs* of red wines, and sampled those produced from vines which were grafted on resistant stocks, the same as I did in the Barsac district, renowned for its excellent white wines, of which the Château Yquem, made near Sauterne, has a world-wide reputation. Phylloxera exists pretty well everywhere. For some time the wine-growers treated the infested vineyards every year with curative doses of bi-sulphide of carbon, at the rate of a little over 1 ounce per square metre; but this sort of *modus vivendi* was at last found expensive, and financially, in many cases, a *modus moriendi*; thus resistant vines have been resorted to, and the standard of even the very highest brands have not in the least been affected thereby.

At the same time it cannot be denied that the general standard of French wines, during the ravages of phylloxera, has fallen to a certain extent; but the phylloxera-resistant stocks are not in any way responsible for this. The reasons are various, and I will explain them now.

France is a wine-drinking country, besides doing an export trade of wines, which is no small item in the total exports of that nation.

Before the parasite had greatly reduced the wine output, this had in some of the most favourable years reached the figure of 1,350 millions of gallons. The destruction caused by phylloxera had brought the crop down to one-third of that, viz., to about 450 millions of gallons. To meet the demand for the local consumption, and in order to keep up the supply on foreign markets, the deficit was partly filled by importing heavy wines from Sicily, Southern Italy, Spain, Algeria, Dalmatia, Greece, for blending purposes, partly by importing raisins and employing them in wine-making. A large use of sugar was also indulged in, favoured by law, insomuch as it was granted that any such sugar employed in wine-making would be free of octroi duty. Thus the systems of wine-making known as *petiotisation* and *gallisation* were freely availed of. Many more manipulations were largely followed, in order to place on the local market a drink that would be as near to genuine wine as possible, wholesome and accessible to every person. Many such liquids were very pleasant; some of them were got up so well as to nonplus experts; but there is no doubt that if France succeeded in keeping her export trade in spite of such decrease of genuine French wines, it was principally due to the import of the best heavy wines from Sicily, South Italy, and Spain, which formed the basis of clever blends.

I shall not extend in describing what sorts of manipulations were then carried on, as I do not wish that there should happen to me what happened to that divine who, in denouncing a certain indulgence of his parishioners, was rather profuse in details, which tickled the curiosity of the simple-minded section of the brethren, thus becoming the unconscious cause of a recrudescence of wickedness among his flock. In any case, the *sucrage,* that is, the addition of sugar to musts deficient in that ingredient is even now allowed; and the law passed on the 24th January last year regulated and restricted this practice. I shall deal with this subject later in this report.

The terrible losses suffered by the vignerons, and the dismay in which they were thrown by the prevalence of the pest, did not prevent the reconstruction of the French vineyards. By grafting on phylloxera-resistant stocks it was possible to grow grapes and to make wine again, and what was more important, to cease from being tributary to foreign countries, such as Italy and Spain principally. Italy, for many years up to 1888, had enjoyed a special tariff for her wines imported in France, and it meant millions of pounds sterling going out of that country every year. The tremendous impulse given to wine-growing in Algeria was also the consequence of the wine crisis in France.

Wine Grapes at Howlong Viticultural Station. Cabernet on
Riparia Gloire de Montpellier.
Grafted in 1900.

There being such a shortage of wine in France, those who replanted vineyards looked not so much to quality as to quantity, therefore varieties of vines which were known to be the heaviest bearers were grafted on resistant stocks. Rich flats instead of hills were preferred. The Aramon for quantity of juice; the Jacquez, which is another heavy cropper, gives a dark-coloured wine, and is middling resistant to phylloxera in certain French districts; the Teinturier also is extraordinarily rich in colour, and several other sorts, all more or less giving wines of indifferent quality, but characteristic for quantity or colour were largely planted. The nature of the ground was not considered the important factor it used to be of yore, soils rich in organic matter, deep and loose, fairly moist where no sort of phylloxera-resistant stock would fail, and where the Riparia is more naturally adapted, were chosen. Now, considering that the varieties that have been chosen are naturally large yielders, that generally vines grafted on phylloxera-resistant stocks bear for the first years at any rate more

than the same vines not grafted; that the soils in which they were planted are very rich, and that in these soils the Riparia stock was preferred, which more than any other stock causes the vine grafted on it to produce largely, we have the explanation of the curious fact of a French wine crop greater in quantity than France ever produced before the ravages of phylloxera. To the realisation of this paradox other factors contributed, to wit, the various systems of pruning, devised and popularised, such as the *Quarante* method of training the vines, the *Sylvoz* cordons and others.

Wine Grapes at Howlong Viticultural Station. White Shiraz on *Riparia Gloire de Montpellier.*
Grafted in 1900.

This extraordinary increase in the output, however, is at the detriment of quality, a lot of it is a little better than *piquette* and is burnt for spirit.

The French vigneron has overcome phylloxera, and after a gigantic work he has reconstructed most of his vineyards. Under the pressure of the new but temporary conditions of a short crop he followed a course that would not answer afterwards. Before there was shortage; now there is plethora; and all wine-growers, except the very few lucky ones of the best accredited districts, are bewailing that they cannot find a market for their produce. To phylloxera a sequel of other pests followed; and among the worst of the fungoid diseases must be mentioned the *plasmopara viticola*, the *black rot*, the *pourriture grise;* while the *cochylis* is another terrible scourge of the insect order. According to the season, any of these diseases will in one year cause as much damage in a district as phylloxera ever did in three. Yet there is glut, and the expenses for the cultivation and fighting the pests are as heavy as ever. All these parasites, and others not so

widely spread or less harmful, affect the grapes in spite of a congery of remedies more or less successful. They outbreak every year in one district or other, or all over the vine territory. Grapes are deteriorated; and here lies another reason for the lower standard of French wines, as compared with that when viticulture in Europe had not so many redoubtable enemies in parasitic life.

Tendency to raise the Standard again.

Naturally scientific progress was spurred against so many adversities, and methods of vinification have already improved to counteract the effects of so many evils. The principal fault thus still remains in the unduly large propagation of the heaviest-bearing varieties of grapes, or of those with grapes richest in colour. A campaign has already begun against them, and their substitution with the choicest sorts which have made French wines famous is insisted on. The output will be less, the standard high. The cost of production will decrease; prices will go up. Equilibrium is sought in place of the chaotic state created by sudden losses and the consequent desire of speedy financial recovery, by failure of the supply of a great national article of diet, and the imperative necessity, from both health and social points of view, of keeping it up as best as possible.

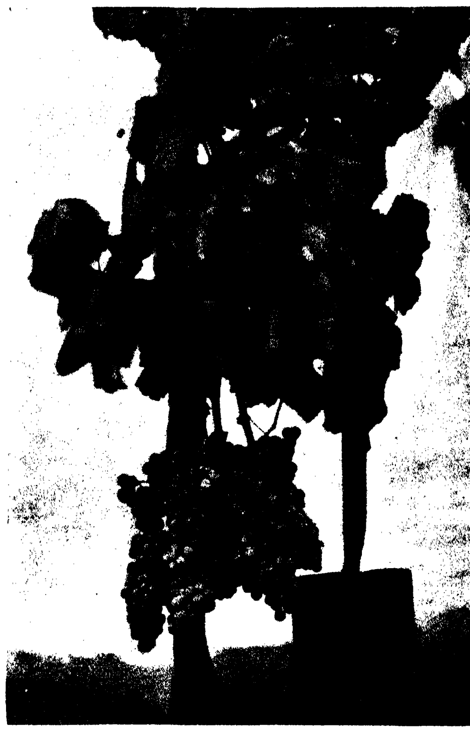
Wine Grapes at Howlong Viticultural Station.
Tokay on *Rupestris Martin*.
Grafted in 1902.

When a nation is struck by a calamity, normal conditions cannot be brought about with the same rapidity with which the disaster occurred. Expediency may in many cases save the position, and the normal level must be reached afterwards by degrees, and often by undoing what in the evil times was the wisest thing that could be done. French vignerons are now about to engage in the last phase of the colossal work, with the view of bringing in real harmony the two factors which are usually in anthitesis—that is, quantity and quality—and so meet the exigencies of a hypercritical public.

This will be the final task whereby the old equilibrium existing before the phylloxera period will be regained, and they may be trusted to bring to bear the same intelligence and perseverance which have distinguished them all along.

Reconstruction of Vineyards in the Cognac District.

Although the vineyards of New South Wales are planted in districts where lime as an ingredient of the soil is generally rather deficient, the reconstruction of the vineyards in the Cognac districts and surroundings, the ground of which is so eminently rich in lime carbonate, would be of relative interest to our growers. In any case, I wanted to visit the Charente to glean any fresh information as to the state of the brandy-making industry—in its district *par excellence*—and as it is impossible to separate wine or brandy making from viticulture, the inquiries upon the one subject naturally reflect upon the other; but even from the purely viticultural point, the visit promised to be interesting, as will be seen by the following references. Besides, the town of Cognac is possessed of a viticultural station, which is engaged not only in experimenting phylloxera-resistant stocks suitable for the locality, but gives vignerons advice on vine diseases, wine-making, &c. In this paper I will write only on the purely viticultural subject.



Wine Grapes at Howlong Viticultural Station. Malbeck on *Rupestris Metallica*.
Grafted in 1902.

Chlorose or Yellow Disease.

It was mentioned in the preceding article that phylloxera-resistant stocks suffer more or less from the presence of much lime carbonate in the soil. I shall now give further information. With the exception of a few types, all the others, especially when grafted, are subject to *chlorose*, which is a malady whereby the formation and quantity of chlorophyll is affected, causing in its acute form a general anæmia of the plant. Chlorophyll is the green substance of leaves, without which these are unable to accomplish the synthesis of the hydrates of carbon. A general denutrition of the plant system is often enough followed by its death.

The intimate cause of *chlorose* of the resistant vines on account of the prevalence of lime carbonate in the soil is yet obscure, although many explanations have been put forward.

Several other circumstances have been mentioned as possible causes of the yellow disease, such as excess or deficiency of plant-food in the soil, deficiency of iron, excessive moisture, sudden changes of temperature, compactness of the soil, which, however, may only explain individual cases. On the contrary, the presence of a high proportion of lime carbonate in the ground is constantly conducive to *chlorose* in the majority of the sorts of phylloxera-resistant stocks.

Wine Grapes at Howlong Viticultural Station. Pedro Ximenes on *Cabernet Rupestris*, No. 33.
Grafted in 1902.

The different stocks have been tried in limestone soil in which the quantity of lime varied, and the maximum of lime carbonate that each sort will tolerate has been noted, but such data do not find a general application. It is not so much the quantity of this compound that exists in the soil, but the proportion of it that is ready for absorption by the roots; its mechanical texture is therefore a very important factor, and moisture is another.

The study of the geological origin of a soil is of great help, insomuch as it will generally tell the state of friability and the other soil ingredients with which the lime carbonate is mixed, also the disposition and depth of the strata within which extends the root system of the vine. When lime carbonate is associated with clay in a soil, the *chlorosing* influence of that soil is of a lesser degree, because the particles of the former ingredient are enveloped by the latter, and are so isolated that the roots come less in contact with them. Such is the case in the low country near Cognac, where the *Riparia* stocks, which are most sensitive to lime, thrive well in a soil which contains about 30 per cent. of lime carbonate, besides being fairly wet. When, instead, it is associated with sand, it is the sandy grains that are enveloped by the lime carbonate, and

the roots then come in immediate and more extensive contact with the objectionable ingredient. When the subsoil is very calcareous and hard, it is advisable not to break it up, and much less to bring it to the surface. Shallow planting should be preferred, so as to keep the roots within the top-soil layer. This, however, may be suitable in a country like the Charente—not very hot in summer, and with a normal rainfall spread all over the year. Such a system applied in certain districts of Australia would cause the vines to intensely feel the heat and the drought.

Of two soils containing the same percentage of lime carbonate, and all other conditions equal, the one in which that ingredient is more crumbly and is in finer particles possesses a higher *chlorosing* influence than the other. In a hard calcareous soil the yellow disease is aggravated, because the roots cannot extend, and grow with difficulty; furthermore, in hard soil the *white* rot of the roots is always prevalent.

Table Grapes at Howlong Viticultural Station.
Black Hamburg on *Rupestris Martin.*
Grafted in 1902.

All other conditions being equal, the limestone soil in which moisture is greater, renders the phylloxera-resistant stock more susceptible to *chlorose*. This fact receives constant proof almost every year in one district or other. After a protracted period of rain in summer, vines grafted on phylloxera-resistant stocks, and planted in calcareous soil, almost immediately show a yellow tint, which becomes green again as soon as rains stop and the ground returns to the normal condition of moisture. When I visited the vineyards of the Charente it had been raining for some time just previous to my inspection. Many vineyards grafted on stocks like the *Rupestris du Lot*, *Aramon* x *Rupestris No.* 1, and *Chasselas* x *Berlandieri No.* 41, which stand a high proportion of lime carbonate, all showed a yellowish hue which they had not before the rain had commenced. Again, it is common to notice the yellow disease at spring time, when the soil is still moist from the winter rains, but the affection disappears in summer if the summer months keep dry.

A vine that is not grafted stands a good deal of lime carbonate without becoming *chlorotic*, but after the graft it is apt to be so. Very few sorts of phylloxera-resistant stocks would die of this disease in a limestone ground if they were not grafted, but the graft generally

weakens the plant, by disturbing its normal functions; hence the susceptibility of the grafted stock to *chlorose*. This susceptibility is intensified if the graft is not well healed.

It is always better to reconstruct a vineyard with ready-grafted vines than planting out the stocks in the vineyard first and then grafting on them. Any disease or accident that weakens the plant may determine *chlorose*. Therefore any fungoid or insect pest, and principally the action of phylloxera, on the roots of a stock even sufficiently resistant, are conducive to the yellow disease. This malady is hardly manifest at the first year of planting, but it reaches its highest intensity in the second and third year. Then the plant either dies right out, or, if it survives, there are many chances that *chlorose* becomes more and more attenuated as years go by.

Sulphate of Iron as Curative of Chlorose.

A mild form of this malady may be cured by applying a soluble iron compound; the iron sulphate, being the cheapest, is generally recommended. When this remedy is given, dissolved in water, it should be applied early in spring, about the time when the vines are ready to bud; a proportion of 1 lb. to 2 lb. dissolved in 2 gals. of water is suggested for every plant. If sulphate of iron is given in crystals, then the same quantities per vine stand good, but it should be applied in winter.

In the Charente some vignerons apply from 2½ to 5 cwt. per acre, and it is incorporated in the soil with the manure. Spraying the vine leaves with a solution of 1 per cent.—as a maximum strength—may cause the leaves to become green again. Often only the portions of leaves wetted by the solution turn from yellow to green, in any case the effect is not permanent, and spraying must be repeated. The best manner, however, to cure *chlorose* is that which goes by the name of the expert who first applied it—the Rességuier system. It consists in daubing the cuts caused by pruning with a solution of iron sulphate 30 per cent. strong. The application must be done in autumn. It is in autumn that plants are apt to absorb any liquid with which any fresh wound is treated; in spring, on the contrary, there is exodus of the surplus liquids proper to the vine, commonly known as "bleeding." If the lotion of iron sulphate were applied in spring the treatment would be ineffective, as the remedy, rather than absorbed, would be repulsed. Not only the remedy should be applied in autumn, but care should be taken to do so before rains set in. It has been noted that vines planted in wet soils absorb less liquid through the fresh cuts operated on them, than those growing in soils with a normal degree of moisture.

However, all these remedies are palliative, and no vignerons should plant in limestone soils resistant stocks which would bring about *chlorose* of the variety grafted on them, relying on any of the mentioned cures to overcome the trouble.

If *Riparia* were planted in such soils, no quantity of iron sulphate would prevent the yellow disease, and at the second or third year the vine will succumb.

Such remedies may be resorted to only in cases of minor mistakes.

Attempts with Curative Methods in Charente.

I might mention here that before the vignerons of the Charente decided on the reconstruction of their vineyards on phylloxera-resistant stocks, they attempted to save the infested ones by the application of curative methods. They attempted a cure in the same way as other vignerons in France and elsewhere, by applying every year a dose of carbon bisulphide or of potash sulpho-carbonate, which increased the cost of cultivation of £3 to £6 per acre and per year, a burden that even in that brandy district, where viticulture is so highly remunerative, vignerons felt it was too much to bear. Besides phylloxera was so swift in its destructive work that many vineyards became beyond recovery before the vinegrowers could make up their mind about what to do. In the end they had to undertake the same work which was being started in other French districts—to graft their pet vine, the Folle Blanche, on resistant stocks. The first trials were made in 1880—that is, eight years after the first outbreaks of phylloxera had been reported in the lower Charente, making short work of many vineyards the while.

The Vitis Berlandieri and the Reconstruction of Vineyards in the Charente.

Unhappily, the reconstruction on resistant vines was to present in this particular territory difficulties not existing in others. The stocks then in vogue failed whenever they were planted in soils rich in limestone. It was in consequence of this failure that M. Viala went to America a second time, searching for stock that will live and grow in calcareous ground. The *rara avis* was met with in Texas, where there are soils much like those of Charente. The *Berlandieri* vine was imported into France.

The discouragement which followed so many failures with other stocks made vignerons incredulous, and the new stock imported left the majority of them indifferent. This new type, although suitable in that sort of soil, had so many drawbacks that no wonder the uneasiness of vignerons lasted for some time. The *Berlandieri*, in fact, is hard to strike by cuttings. By planting 100 cuttings of this stock only five may be expected to grow and they grow very slowly at that. The long and laborious work of raising seedlings from this species and selecting among them the more vigorous types, and experiments as to the best way to get these cuttings to strike more freely, were undertaken and happily were attained with a high degree of success. To-day there are two types of *Berlandieri*, known as *Berlandieri Resseguier No. 1* and *Berlandieri Resseguier No. 2*. The latter seems to be superior to the former for its great vigour.

If the *Berlandieri* stocks are pruned in autumn, while the leaves still hang on the vine, and the bottom of the cuttings are grated

against a steel comb so as to lacerate the bark over a length of an inch or so, and then kept in sand until planting time, a greater percentage of slips may root. Yet it cannot be said, even to-day, that the question of the propagation of the *Berlandieri* resistant vine is quite easy and always reliable. An expert claims to have obtained a very satisfactory percentage of rootlings from cuttings which were dealt with as follows:—In spring the shoots from which it is intended to obtain cuttings are ringbarked below one of the bottom eyes—that is, below the eye which will be bottom bud when the cane is severed from the mother stock. It would appear that the increased storage of nutritious matter above the incision and the histological modification of the tissues of that upper portion which, when the cane is separated from the stock and planted, will find itself underground, will predispose it to freely emit roots.

Table Grapes at Howlong Viticultural Station.
Doradillo on *Rupestris Martin.*
Grafted in 1902.

The *Berlandieri* is a very hardy stock; its resistance to phylloxera is of the highest; it suits better than many other sorts in very poor stiff and dry ground; it grafts very well and very neatly with the majority of European varieties. Its crop is the earliest to ripen, but the grafted stocks will only be in full bearing five or six years after they have been planted, instead of after four like all the other sorts; but once it has reached full development it keeps so without any falling off.

But notwithstanding so many good qualities, even the best forms of *Berlandieri* have not found the popularity of other stocks on account of the two drawbacks already referred to; but in the hybrids evolved from this species, the two inconveniences are very greatly minimised, while the good points are found in them integrally. The eminent qualities of the *Berlandieri* hybrid render them invaluable, not only for the reconstruction in limestone soils, but in other grounds as well, specially those hard and dry, where the *Rupestris du Lot* and some of the *Rupestris* hybrid would not thrive too well.

It results from the foregoing that the soil formation of the Charentes has been, and to a certain extent is still, responsible for the comparatively slow progress made in that country in the reconstruction of those vineyards. The undulating plains of the two Charentes districts before the visitation of the scourge were all an

immense vineyard, bearing enormous crops of white wine principally, from the distillation of which the highly reputed French brandies were obtained. At present the area under vines is much reduced, and where there were vineyards, wheat is now sown. Gigantic efforts are, however, being made for the rehabilitation of the viticultural industry of that country, which means the restoration of its old ascendancy as a brandy-producing district.

Of the phylloxera-resistant stocks now employed, there are several, and the factor which determines the choice of a stock in preference to another is the quantity of limestone contained in the soil which it is intended to replant with vines. All the sorts planted, or likely to become popular after ten years' experiments conducted at the viticultural station, may be grouped under two classes of hybrids, viz., *Rupestris* x *Berlandieri* and *Franco* x *Berlandieri*.

Table Grapes at Howlong Viticultural Station.
Black Prince on *Rupestris Martin.*
Grafted in 1902.

It would have been impossible anywhere to gain so much practical information regarding the new viticulture, such as necessarily caused by the adoption of phylloxera-resistant stocks, without multiplying the number of viticultural stations, where the many problems connected could be first scientifically resolved and vulgarised for practical application afterwards.

Considering the importance of the Cognac and surrounding territory, and the almost exceptional geological formation, such an institution was soon felt by the leading and more enlightened viticulturists and brandy-making people of that country. The viticultural station is an offspring of the local Viticultural Association. There is a laboratory for chemico-physiologic researches, and grounds are annexed for testing the various stocks, of which there is a large collection.

At the Marsville experimental vineyard the soil varies, and contains proportions of lime carbonate from 50 per cent. and over; the soil, therefore, is here typical of the greatest area of the Charentes. The ground is phylloxera infested; thus the resistance, as well as the power of withstanding a high proportion of this ingredient, may be tested for all new types placed on the market, and often much advertised by vinebreeders and nurserymen. In this way reliable information is

afforded to vignerons by the Expert, who has no other interest but the general welfare, and who is placed in the best position to sum up the qualities and faults of all the stocks under experiments, and protect the vinegrowers from wasting time and money. Going through this vineyard, the visitor will see rows of certain sorts growing and bearing luxuriantly alongside others affected by *chlorose* and not far from death, while other rows, of different varieties, have already succumbed either to phylloxera or to yellow disease, or to both.

The negative results, so often misunderstood by laymen, are of higher value to the public at large when they relate to subjects upon which the general experience is not yet fixed, in so much as it saves great losses to the community.

The staff of the Viticultural Station of Cognac makes soil analyses free of charge, gives consultations, lectures, publishes articles in the local newspapers, and does everything conceivable to help those engaged in the viticultural industry of the district.

While in Sicily, the *Berlandieri* specie and its hybrids have been tested in calcareous soil, but under a hot and dry climate, here a budget of information is already available, reflecting similar conditions of ground, but under altogether different prevailing weather, this region of France being relatively cold and with a fairly large rainfall.

According to the Director of the Station, all the *Rupestris* x *Berlandieri* hybrids known at present may be very little utilised for

Table Grapes at Howlong Viticultural Station. Malaga on *Rupestris du Lot.*
Grafted in 1901.

extensive plantation. The vines grafted on them bear well, although irregularly. They strike roots freely, but the percentage of successful grafts is lower than is the case with other sorts of resistant stocks.

The *Rupestris* x *Berlandieri* 301 A, 301-28, 301-64, 301-43, 218-1, 219 A are, says M. Guillon, among the best; but, in general, they are inferior to the *Berlandieri* x *Riparia*.

Table Grapes at Howlong Viticultural Station. Duke of Buccleugh on *Rupestris du Lot*.
Grafted in 1901.

The *Berlandieri* x *Riparia* 33 is a very good stock. The *Berlandieri* x *Riparia* 34 is equally good, middling vigorous, the vines grafted on bear plentifully, but, as the vine grows older, is affected by the higher proportion of lime carbonate in the soil.

The *Berlandieri* x *Riparia* of M. Gautier, although little known, is one of the best. The *Berlandieri* x *Riparia* 157-11 is also a very good stock: it is vigorous; the vines grafted on it bear largely, but it requires soils not very stiff, not containing very high proportion of calcareous ingredient; it does not strike so very freely, and the percentage of successful grafts is smaller than is usual with other stocks.

Among the *Franco* x *Berlandieri*, the *Chasselas* x *Berlandieri* 41 B is one of the most reputed, and every year more vineyards are reconstructed with this stock. It roots well, takes the grafts freely, bears very regularly large crops, thrives even in the most calcareous soils of the Charentes, and adapts itself to the poorest grounds with shallow top soil. It even beats one of the best *Franco* x *Rupestris* known at present, viz., the *Mourvèdre* x *Rupestris* 1202, although less vigorous.

For instance, one acre of vines five years old, grafted on *Chasselas* x *Berlandieri* 41 B gave 1,040 gallons of wine; on *Mourvèdre* x *Rupestris* 1202, gave 613 gallons of wine, and the alcoholic strength of the wine is higher in the former.

There are several other *Franco* x *Berlandieri* which, so far, have given splendid results, although it is too soon to express a decided opinion. Thus the natural hybrids, *Viniferæ* x *Berlandieri* of M.

Millardet, grafted with *Folle Blanche* have, in certain years, given crops corresponding to 1,800 gallons of wine per acre, and the wine contained 11 per cent. of alcohol, equivalent to 18·4 per cent. of proof spirit.

The *Berlandieri* x *Pinot Blanc* 422-34-21, grafted with the same *Folle*, have yielded in proportion of 1,600 gallons per acre.

What is more striking is the hardiness of these hybrids of the *Berlandieri* with the European varieties. The ground in which they are grown has but 6 to 8 inches of top soil, containing 55 per cent. of lime carbonate, and the subsoil was never trenched. Never any manure, whether organic or mineral fertilizer, was applied, not even when planting. The system of pruning is the ordinary gooseberry-bush fashion, and the grafts were operated on the stocks after they had been laid out in the vineyard, which system, especially in limestone soil, is a cause of weakness. In view of the fact that *Berlandieri* hybrids thrive just as well in non-calcareous soil, they ought to be a great boon for many hard poor grounds of the State of New South Wales.

The Success of Hybridised Vines as Stocks.

I made mention in the preceding article that a great opposition was made to the phylloxera-resistant stocks which had been obtained by crossing two species of American vines, or by crossing an American vine with a variety of *Vitis vinifera*, viz., an European variety. The

Table Grapes at Howlong Viticultural Station. Temporano on *Rupestris du Lot.*
Grafted in 1901.

strongest objection was made to the *Europeo* x *American* crossbred, fearing an attenuation of the power of resisting to phylloxera to a degree that would make them unfit for practical use. In fact, out of the many thousand hybrids obtained by the artificial cross pollinisation, a relatively small number have survived and are now accepted, and

there is no doubt that the future of the new viticulture is in that direction. The crossing of European and American vines is still going on, and out of the great number evolved it is certain that a few more worthy ones will be added to those now in vogue, and perhaps be superior. At all events a number of *Franco* x *American* hybrids are finding large application in France, and besides the *Franco* x *Berlandieri* already referred to, the *Franco* x *Rupestris* especially are being planted on a large scale in several French districts.

M. P. Gervais, secretary to the General Association of the French Vine-growers, is an eminent authority on the question of phylloxera-resistant vines. He is also a vigneron—owner of a vineyard of 500 acres, all planted on various resistant stocks, among which the *Mourvèdre* x *Rupestris*, 1202, and the *Aramon* x *Rupestris Ganzin, No.* 1, have given the best results. The grafted vines are now over 10 years old, and although the roots of the stocks have shown all along numerous phylloxeræ and nodosities, yet they never manifested the slightest sign of wasting away. M. Gervais attributes the superiority of the two *Franco* x *Americans* over any pure American species or *Americo* x *American* hybrids to the greater affinity of the former for the variety of grape grown in the district, and for their higher adaptive power to the class of soil. The yield of the vines grafted on these two stocks is at the rate of 1,800 gallons per acre in the flat portion of his vineyard. He calls them "the columns of the reconstruction of his vineyard."

Of the same two stocks I spoke at length in relating my tour through Sicily, where, on account of the warmer climate, it was feared they would succumb under the attacks of phylloxera. I explained that even there they have proved reliable, that the confidence in them is increasing, and that they are taking a conspicuous place in the replanting of the vineyards that have been destroyed by the parasite.

Having proved their practical resistance in various soils, under northern and southern climates, we are, I think, justified in extending our confidence to them in New South Wales, and I intend to increase the number of rows of the *Mourvèdre* x *Rupestris*, 1202, and *Aramon* x *Rupestris, No.* 1, mother stocks now existing at the State Viticultural Station of Howlong, which at the outset I purposely confined to a few.

Phylloxera-resistant Stocks in Champagne.

The Champagne district was one of the last to become phylloxera-infected. The first outbreaks of the pest in France occurred in the southern provinces, and naturally it took some years before it overcame all opposition and reached the territory of Marne et Châlons, wherein the Champagne country is situated, which fairly represents the northern limit of the vine-growing industry of France.

It is generally known that on every acre as many as 20,000 vines are growing on the average. A smaller number are planted when forming the vineyard, but in the following years every vine is layered and so forth until the above number is reached, and the plants are so close that there is hardly any room to walk through. Naturally they

are small, and usually bear not more than two or three small bunches. The layering is done simultaneously with the winter hoeing of the soil,

Raisin Grapes at Howlong Viticultural Station.
Thompson's Seedless, on *Rupestris du Lot.*
Grafted in 1900.

and the cost of the operation is small. Being a cold climate, very shallow planting and shallow layering is resorted to, and consequently a few inches below the surface there is a network of roots and of the layered stems. On this account the contamination is easier, and if it were not for the cold and fairly wet climate of the Champagne hampering the prolificacy of the parasite, its baneful influence would be still more felt.

The extinction of *foci* of infection as they are discovered is followed with great stringency;—at the same time the reconstruction on resistant vines is strongly advocated. It is very strange indeed that after all that has occurred in France, there should be in this district a number of peasant vignerons who still disbelieve the parasitic characteristics of the scourge and its appalling destructive work. Many of them are mooting that it is all a conspiracy of the champagne makers to bring down the price of grapes, while others think that, at all events, if it is really a pest, it is not likely to do any harm in the Champagne soil, and everyone, I suppose, thinks it will keep away from his particular soil.

The reconstruction of vineyards is only at its inception, and it is fair to assume that the same work will be done here that has been done elsewhere in France. However, it is worth mentioning that there is a certain technical difficulty which will stay the work in many

cases, and even after this has been removed, there will remain an unknown factor which experience alone will decide—whether the only possible solution opened to the Champenois will be followed by an absolute success, that is, by keeping up the standard of the aristocratic wine, and by a not too expensive system of vine-growing which would increase the price of purchase.

Although the first attempt at champagne-making does not date back to more than a century and a quarter, vine-growing has been pursued in that district from a much older time. The development of the champagne industry did not in any way change the old manner of growing and cultivating the vines, and I should say that in the manufacture of the precious wine, grapes are utilised such as they have been producing for years, before the genial curate made the first bottles and corked them with (for want of something more suitable) a stick of charcoal.

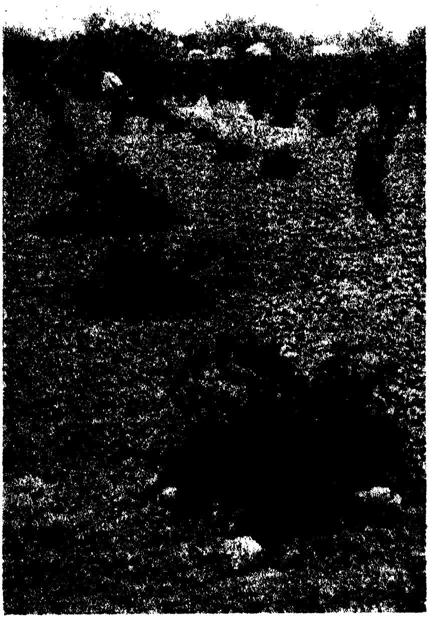
The first necessary factor for turning out good champagne is to start from a high-class still wine, the chemical composition of which must present a certain mutual relation. Quality and chemical composition are the outcome of the nature of the soil, climate, variety of grapes grown, method of training and cultivating the vines, and vinification. Of these six conditions we leave out five, as they would remain the same whether the vines are grafted or not on phylloxera-resistant stocks, and we consider the sixth, that is, the method of training and growing the plant, which cannot be the same as at present if the champagne vineyards are grafted on resistant vines.

Sultanas on their own roots, at Howlong Viticultural Station.

Growing better than those grafted on resistant stocks.

I mentioned that in this particular district a relatively small number of vines are laid out, and that by successive layerings the plantation is made thicker and thicker until some 20,000 vines can be counted in an acre. It is evident then that if the original vines are grafted on resistant stocks, those which are originated by layering the former will grow on their own roots, which are non-resistant, and will surely be destroyed by

phylloxera. It would be therefore necessary either to form vineyards like in any other district—that is, with a much smaller number of plants per acre, or to plant right out 20,000 resistant stocks per acre and then graft on them, or plant 20,000 rootlings of resistant stocks ready grafted with the local grape varieties. The two latter systems are necessarily expensive, and it is likely in consequence that in future the Champagne vineyards will be reconstructed by planting a smaller number of grafted vines and allowing more room to each individual vine. Every vine will bear a larger crop, so the usual quantity of grapes may be garnered;—yet the question that arises is this: Will the 200 gallons of wine produced by, say, 4,000 vines be of a class as good as 200 gallons produced by 20,000 plants? Experience has shown in certain European districts that, say, 200 gallons of wine obtained off an acre containing a larger number of vines, each vine individually being necessarily smaller and bearing less, is much better than 200 gallons of wine produced by a smaller number of plants, each plant being in proportion more vigorous and bearing more largely. In view of this it is possible that if the new Champagne vineyards that will have to be reconstructed on resistant stocks be planted with a much reduced number of plants, the wine may suffer in quality.



Sultanas on *Rupestris Martin*, at Howlong Viticultural Station.
Demonstrating lack of affinity.

The man hoeing is facing the grafted Sultanas, which are very poor compared with those non-grafted, as shown in the preceding plate, and are expected to die. The first three vines are *Rupestris Martin* mother stocks, which have been replanted after failure of the grafts.

This is a purely speculative thought that I ventured to mention to the manager of the well-known Champagne firm of Moet et Chandon, of Epernay, and I found that the people there pondered over the same subject and were concerned about such possible shortcomings. Nothing positive, however, can be said yet, and future experience alone will be able to tell.

(*To be continued.*)

Hawkesbury Agricultural College and Experimental Farm.

The Pig Industry.

H. W. POTTS.

II.

The Boar.

Mongrel, crossbred, or inferior boars have contributed in no small degree to limit the profits of our farmers and pig-raisers, and to create a prejudice against the pork industry. An ill-bred boar in any district is nothing short of a calamity.

The cardinal principle involved in successfully establishing a piggery is the selection of the animals. The boar unquestionably occupies first place. The most suitable breed can only be determined by the available food supply and the class of meat likely to meet with market demands. The aim is to breed from stock possessing all the qualifications to keep up a vigorous, quickly-maturing, healthy, and prolific race. In this the boar exerts a preponderating influence. Care should be taken to purchase an animal from a reliable source, where pedigreed stock only are bred. The importance of pedigree cannot be over-estimated in tracing the history of ancestors, and in estimating the essential qualities to be transmitted. A boar may, in markings, external points, and general condition, appear in every detail quite equal with the pedigreed sire, but he may fail to transmit many valuable hereditary qualifications. Pedigree necessarily depends on its authenticity and completeness, in which inherited merit, such as purity of blood, stamina, constitution, and other potent qualities are assured. The worth of pedigree is fully recognised by experienced breeders.

There can be no difference of opinion as to the ill-effects of in-and-in breeding amongst pigs. This term indicates the breeding together of animals more or less closely related for a number of successive generations. None of the domestic animals exhibit symptoms of impaired fecundity more readily than the pig from this cause. Mr. John Wright quotes a telling instance of this in the Journal of the Royal Agricultural Society, vol. VII, p. 204. He states : "In pigs, the writer's experience was considerable, in breeding from three or four sows at the same time, all descended from the same parents, boar and sow. These were put to the same boar for seven descents or generations. The result was that in many instances they *failed to breed*, in others they bred few that lived. Many of them were idiots—had not sense to suck; and when attempting to walk they could not go straight.

"The last two sows of the breed were sent to other boars, and *produced several litters* of healthy pigs. In justice to the advocates of the in-and-in breeding principle, it is but right to state that the best sow during the seven generations was of the last descent. She was the only pig of that litter. She would not breed to her sire, but bred to a stranger in blood at the first trial. She possessed great substance and constitution, and was a very superior animal."

Following a close scrutiny of pedigree and an inspection of the parents, where possible, in the selection of a reliable sire, there are a number of points recognisable externally which mainly apply to all breeds, and are useful guides.

A good length and depth of body, wide, compact, and firmly set on short, straight legs, of fine bone, are prominent features. A strong, muscular development and vigorous constitution is evidenced in a capacious chest, with large girth immediately behind the shoulders, giving ample room for healthy heart and lung action. A boar with wide shoulders, well filled up and set back, is noted for early maturity.

The head should be wide and deep between the eyes and ears; the eyes bright and lively; the neck moderately wide and deep, somewhat short, fairly thick and muscular; the ribs well sprung and deep; the loins wide and thick; flanks deep and full; a level back, or slightly arched; quarters long and straight from hip to tail; hams large, full wide, and well let down on the thigh; legs straight, fine, wide apart, and planted firmly on the outside of the body, with short pasterns; bone flat and fine; skin smooth, clean, firm, and scurfless; hair bright, long, fine, short without mane or bristles along the neck and shoulders, indicating good breeding, thrift, and vigour—coarse hair, on the contrary, points to lack of refinement in breeding and coarseness in the grain of the flesh; a fine muzzle; an easy, active, and distinguished carriage, giving a lively and animated appearance; a general smoothness and symmetry of outline.

A special qualification is the possession of a gentle, docile, and tractable disposition. A bad temper is invariably transmitted.

The animal should be selected from a large litter, in which uniformity of markings, size, and vigour are prominent. Both testicles should be visible, and evenly suspended in the scrotum. The embryo teats should be full in number, evenly placed, and distinct in development.

It is not possible to fairly judge a young boar just weaned. The powers of the digestive functions are unknown at that period. His disposition, ability to put on flesh, capacity for stock-getting, and pre-potency, can only be estimated after the birth of his first litter.

Treatment of the Boar.

After weaning the young boar should be intelligently nurtured and fed to encourage a full growth of frame and muscular development. Up to the age of four months he may be permitted to feed with other pigs. Afterwards a comfortable and well-aired shed or house should be provided, with a dry floor, a good bed, shade, water, and ample

space for open-air exercise. A sandy soil is preferable. Grazing on open pasture of couch, paspalum dilatatum, or lucerne is useful; the latter provides all the elements for the growth of bone, muscle, flesh, and nerve tissue. A few bones thrown to him occasionally are always relished. Wood ashes or charcoal serve a good purpose. His food should be varied and palatable. The following foods provide a suitable assortment:—Skim-milk, butter-milk, grain, peas, beans, clover, vetches, soy bean, ground nuts, millets, maize, sorghum, rye, roots, fresh kitchen swill, pollard, bran, rape, copra cake, pumpkins, linseed cake, rice meal, cowpeas, and other foods in which the nitrogenous elements are prominent. The boar is best kept a in separate pen and yard from the sows. It would be a further advantage to have it situated far enough away to prevent him hearing the peculiar calls sows make during the periods of sexual heat.

The object is to avoid tardy growth and keep the animal steadily increasing in size towards full maturity. Food should be given at regular intervals; "little and often" implies that condition, or at least three times a day. During the height of summer the diet should be light and nourishing. Kitchen swill strengthened in soup form with grain and supplemented with the green succulent paspalum dilatatum grass, or lucerne.

Boars mature on the early side in our warm climate. That, however, does not warrant the animal being utilised for stud purposes. It is better to keep him until all his powers and strength have fully matured. For stud service he should not be used under eight months old, and he is all the better for being allowed to reach twelve months.

The first season should be confined to the service of from six to eight sows, with long intervals between each service. The following season he may be permitted to serve from forty to fifty sows. These, of course, are to be divided into two lots. It will be necessary under such conditions to feed him liberally on rich stimulating food, especially grain. The sow should be driven into the boar's pen on the first appearance of sexual heat or hogging. It is a mistake to permit the sire to roam at will amongst breeding sows and serve as he thinks fit. It is unsatisfactory, and he becomes weakened, restless, irritable, and small litters result. The best time is to mate boar and sow in May, the latter to farrow in August. The young pigs are farrowed under the most thrifty conditions, and are ready for weaning in early summer.

The first hogging or recurrence of sexual heat or œstrum after weaning the young litter is opportune for further impregnation, and thus another litter is arranged for to rear and wean before the winter.

Our stud manager, Mr. Daley, adopts the practice of arranging one service on the earliest symptoms of sexual heat and a second on the third day, just as the œstrual period is passing off. He contends that when the sow is not served the second time there is a chance of the litters being small in number. A boar in good condition may be allowed to serve three to four sows in one day, with intervals of rest of two or three days, or he may serve one each day until the required number have been served. Occasionally a difficulty arises in serving a small sow. The inequality in size necessitates some artificial aid. In this

case the contrivance known as a boar-help may be brought into requisition. That designed by Mr. W. H. Walker, of Tenterfield, and shown on the opposite page, seems to supply the want.

Any boar well cared for and properly fed ought to keep in active serviceable condition until he is 8 years old; as a matter of fact, many boars often prove prolific and virile long after that age. It is known that the most thrifty, profitable, and numerous litters are got by aged boars from old sows. Both sexes have proved useful up to 10 or 12 years old in our climate. One feature, however, has to be noted in aged animals, they lose their teeth and have to be hand-fed to maintain condition. Many boars on approaching the termination of their period of usefulness develop a weakness in the pasterns and move about with considerable difficulty.

Mr. Daley, during his long experience in raising stud-pigs, has had excellent opportunities at this farm to record observations in relation to the determination of sex. He has arrived at the conclusion that this is determined at the time of impregnation. Where the temperament, activity, condition, and state of health is lowered from ill-treatment, inferior food, neglect, and other causes, the boar's influence on the sex of the litter is lessened, and the most of them will be boars; under contrary conditions, the opposite sex should preponderate.

The theory of comparative vigour in which the sex of the progeny is associated with the power of the stronger and healthier parent at the time of service is favoured by Mr. Daley, or in other words the sex is determined at the moment of conception, and is the opposite to whichever parent is at that moment in relatively the more vigorous health.

In the general attention to the boar, the matter of cleanliness should never be overlooked. The pig is not a filthy animal, and with a higher degree of breeding his demands for sanitary and cleanly surroundings are more imperative.

It is as well to remember that the boar should not be trusted too implicitly when attending to him. He occasionally exhibits vagaries of temper which enjoin caution. If it be necessary to chastise him, never use a heavy weapon. You may cause severe injury to him. All that is needed is a light cane in the hand, and any attempt at too close a familiarity can be checked by a slight or smart tap on the snout. This does not injure him in any degree, and inflicts just sufficient punishment to keep him within bounds.

If he exhibits a growing tendency to vicious habits or ill-temper, the sooner he is converted into meat the better.

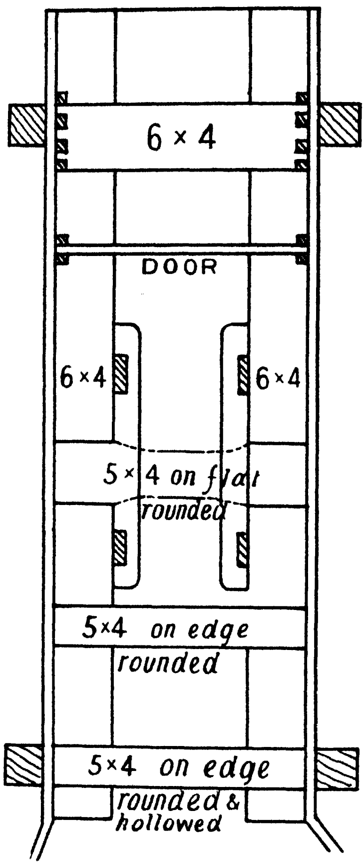
The most complete evidence of a boar's soundness and value for breeding purposes is his own progeny.

If it is not possible, or economical, for one farmer to keep one boar for the requirements of his piggery; in such case, a combination of four to six farmers might find it convenient to purchase a high-class animal to serve the sows on their farms.

Co-operative effort in this direction has been very successful in pork-raising countries, particularly Denmark.

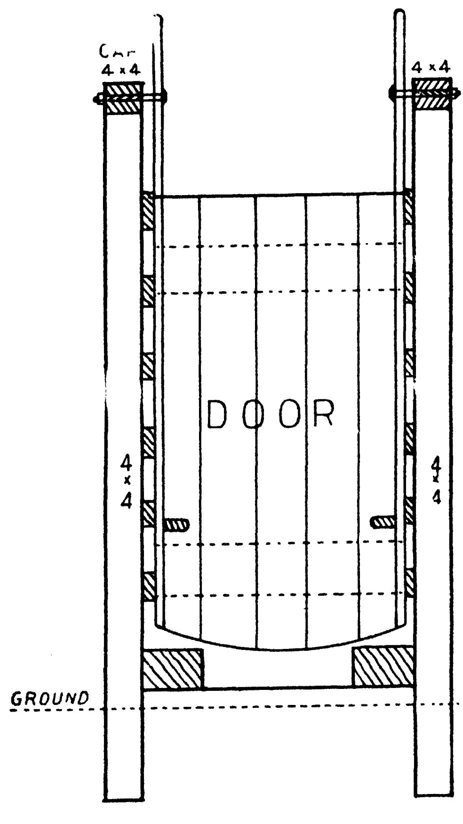
A Boar Help.

Mr. Walker states that he originally obtained the idea from a Victorian pig-owner, but it has been improved at Tenterfield by the addition of two sliding rests, one at each side, for the boar to place his



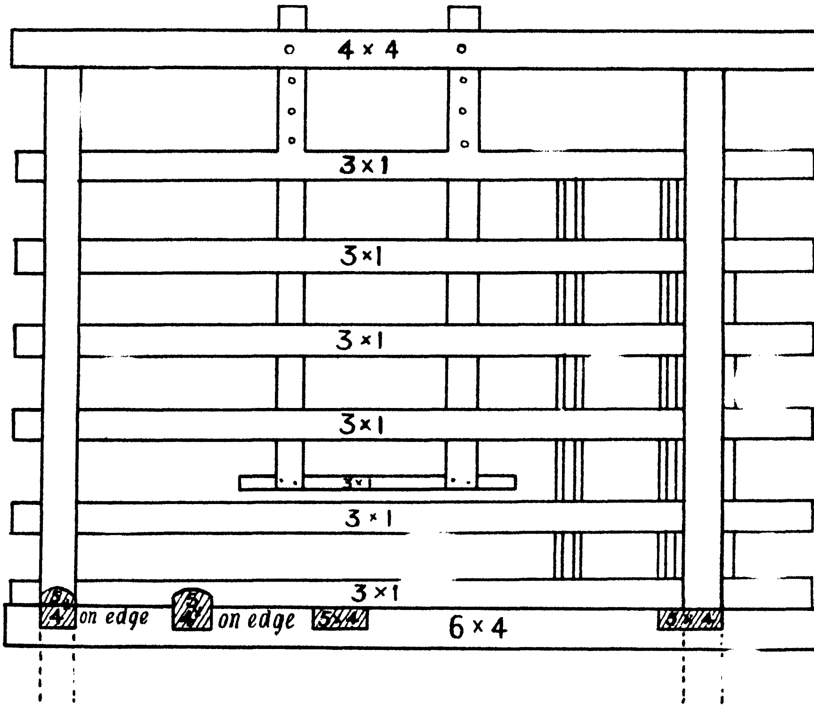
Ground plan.

Cross section at door.



feet upon while serving. The sow is supported by the rounded sleepers, and the rests are dropped so as so come about half-way down the sow's sides.

The advantage of this "help" is that it enables aged, heavy boars to be used with young sows. All the dimensions required are marked



A side view of Boar Help.

on the accompanying diagrams, which, it is hoped are sufficiently clear to enable the contrivance to be made by any bush carpenter. The dimensions are: length, 6 feet; width, 2 feet.

Second Annual International Egg-laying Competition— Winter and Summer Test—April, 1903, to March, 1904.

D. S. THOMPSON,
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Site.

The site on which the Competition Pens are built at the Hawkesbury Agricultural College, is almost on a dead level, with little or no slope, and the only drainage is the porous nature of the soil. Consequently the site is not the best that could be selected for successful poultry raising. The ground is a light sandy loam with a large percentage of sand, heavily grassed on the surface with coarse natural grasses, which after cultivation is overrun with couch (*Cynodon dactylon*). This grass provides plenty of green food for the hens—a most profitable feature of the site.

The sandy ground in wet seasons holds an enormous amount of moisture and every morning a very heavy dew is found upon the surface, when there is far more wet than at the time of or immediately after a heavy rain.

The houses are built facing the north-east and stand pretty well in the middle of the yards with a run partly before and behind.

Construction of Yard and Houses.

The houses were designed and substantially built by the Foreman of Works, Mr. Brooks, at the College Carpentry Department, in which the writer was consulted. They are entirely open in front, thoroughly weather-proof at the back and sides and roof, are well ventilated, having wire ventilation openings at the bottom of the back of the house as well as at the top. A great many friendly critics questioned this idea, suggesting too much ventilation, and too much draught, but we have found from experience that the draught is in the correct place, right over the floor of the house and under the roost, the hens being as cool as cucumbers right throughout the night, which saves them from all catarrhal and pulmonary complaints. To the open front, where the sun can shine fully into the house, and the splendid ventilation, the swinging perches, and with no lumber inside, may be attributed the result that not an insect of any kind has been found in any of these houses after being continually occupied by a dozen hens for twenty-four months.

The nests are outside the house and shaded from the sun and rain. They are bottomless, the sandy ground forming the floor, which is strewn with cut grass, and every now and again tobacco refuse, purchased at 3d. per lb., is sprinkled in each nest. A broody coop stands in each yard; but with all our experiments, we find there is nothing so successful as turning the broodies right outside their own yards, and allowing them to run up and down all day long trying to get through the wire back into their own pens. We also cause them to roost outside on the ground in all sorts of weather. This is very rough treatment, but we find it is very effective. The buildings are each divided to answer for two houses, being 11 feet x 6 feet, and are 5½ feet high in front and 4½ feet at the back. The roofing is of ruberoid. The pens are 87 feet x 17 feet. We find the grass permanent in these pens carrying six hens continuously throughout the year. A few of the pens were completely eaten off at the commencement, which demonstrates clearly that you want to construct your pens on good grass land, and if on cultivated land to allow the grass to grow and get a good hold before putting in the fowls. Once the grass attains a sufficiently vigorous growth to supply the fowls you are all right; but should the fowls eat it out you will have to remove them altogether for a considerable time before the grass will grow again. We had sufficient experience on this point in our first competition. The pens were constructed on land where the grass had been completely eaten off by dairy stock, but when the yards were ready there was a nice shoot of tender short grass. When the hens were put in, in most cases the grass beat the hens, but in some instances the hens beat the

grass and ate it out entirely, so that we had to plant sods of strong couch grass in every one of those pens, in which with a wet and favourable season, we fully anticipate being able to maintain a healthy sward this time.

Feeding.

The natural grasses in a poultry run form the great bulk of food consumed by poultry, consequently good grass runs are half the battle in successful poultry farming. With plenty of natural grass, there is no necessity to feed green stuff in any other way, in fact to do so is only overtaxing the digestive organs, from which there is no return. Only during the winter when the green grass has withered off is it necessary to feed green stuff. Rape, whole in the leaf, has been found the best substitute for the natural grasses. It is relished by the fowls, is sweet and succulent, and has a high feed value. At 7 a.m. the birds have their morning meal of mash, composed of two-third pollard and one-third bran in bulk, but not in weight. The mash is mixed up with strong liver soup two days per week, and the other day simply with water, heated only throughout the cold winter months. It is fed out to them on a basis of one heaped Imperial pint per six hens, but the discretion of the feeder is the all-governing rule, and each pen has just sufficient food for its requirements. No birds are left hungry in the pens, while no food is left in the pens.

Acting on this basis, it has been found, while the appetites of the hens vary throughout the duration of the test, that the breeds that are classed in this pamphlet as big eaters consume on an average a little over the heaped Imperial pint. The hens classed as small eaters consume on an average a little under the Imperial pint. In the evening, 4·30 to 5 p.m., they are fed with grain. It is found that maize and wheat, fed alternately, give the best results in egg production. The maize is best crushed for laying hens. This competition has amply demonstrated that if wheat is higher in price than maize, splendid results can be secured through feeding crushed maize alone. This is a valuable determination. Take up almost any English work, or for the matter of that any Australian work on poultry, and we find the feeding of maize condemned for successful egg production. An enormous amount of matter can be read on feeding poultry, which to the layman is quite bewildering. The scientific feeding of poultry, reduced and put into practice is quite simple and easily understood. The following is a reliable analysis table of the best poultry foods, feed value, and price governing the selection.

	Water	Ash.	Protein.	Fibre.	Carbo-hydrates.	Fat.
Maize	10·6	1·5	10·3	2·2	70·4	5·0
Wheat	15·0	1·4	9·2	1·9	68·7	3·8
Pollard	12·1	3·3	15·6	4·6	50·4	4·0
Bran	11·9	5·8	15·4	9·0	53·9	4·0
Meat	5·4	2·4	58·4	...	...	33·8
Green cut bone	29·7	24·0	20·2	...	...	26·1
Dried blood	8·5	4·7	84·3	...	...	2·5

The application of the foregoing table with natural grass is all that is required for the highest egg production. Maize, wheat, pollard, and bran are the staple foods. There are no better at the same price, value for value. Three tables for meat-feeding have been given. If meat of any kind is to be preferred, then use livers in preference to green cut bone or dried blood. Green cut bone contains too much lime and ash, and dried blood is too rich in protein, and has to be fed with great care, otherwise a heavier proportion of carbo-hydrates would be required (which could not be assimilated) to balance the feeding.

Carbo-hydrates or carbonaceous matter form the bulk of all general foods, and are the principal sources of heat and energy.

Fat, more or less, is also found in all the foods recommended, and goes to store up heat as well as fat.

The protein is the nitrogenous matter, and is the element utilised in the production of bone, muscle, nerve tissue, blood, feathers, and eggs.

Ash consists of lime and other mineral matter, and is only partially digestible. Fibre is husk or waste matter which is not digestible. In this connection it is as well to point out to those who cut up a large percentage of green food and mix with the pollard and bran that the digestive organs are overtaxed with the amount of food consumed in relation to the concentrated food value. When the ingredients mentioned are found in proper proportion in any ration they are said to be evenly balanced, and in the balancing of the feed values lies the secret of success in egg production. That is to say, if you were to feed on meat only, there would be no balance—the protein would be too great, and there would be evil results.

The late Alexr. Comyns, B.A., of England, who devoted his life to poultry, states that a hen about 4 lb. in weight requires—

6·4 grams protein,
2·5 ,, fat,
28·5 ,, carbo-hydrates,

daily, and double that quantity when in full lay.

This competition has demonstrated that Comyns was not quite correct. Pullets in entering an egg-laying competition, at the age of from 7 to 11 months, eat very greedily while developing, and while coming on to lay, they eat a little less if any difference when they are laying, but go off considerably in their appetites when fully matured, and off laying. No doubt Comyns referred to the matured hen, in which case we find him approximately correct. Fibre is an aid to digestion; grit and gravel are also specially required. We use the ordinary sea-shell grit, being much the cheapest on the market. It answers all purposes, and is equal to the much more expensive oyster-shell grit, or any other at double the price on the market. The sea-shell grit answers the dual purpose, *i.e.*, supplies the mechanical action of grit, and provides lime, so essential in egg production. With nothing but sea-shell grit at 30s. per ton, we found Warren's hens to yield considerably over 200 eggs each per annum,

and did not produce a soft shell, showing they got plenty of lime feeding; and throughout the competition it was equally experienced, no soft shell eggs, and no deaths from functional liver disease, as a result of imperfect digestion.

Skim milk, when it can be obtained cheaply, but not otherwise, is beneficial, and can be used for mixing up the morning mash in place of water, but it must be sweet.

Laying hens should be fed on food containing a large percentage of protein and less fat. In boiling livers, or mixing the mash with liver soup, skim milk or water and a little ordinary salt should be added. A properly-balanced ration is 1 to 5, *i.e.*, protein to carbo-hydrates, and for laying hens not so wide, 1 to 4 or 4½.

Beans and Peas.—Give 1 to 2½, which is a very narrow ration, and ought to be good feeding for laying hens, but the question arises as to cost.

Oatmeal is a splendid food, and balances well by itself 1 to 4⅓, but as a rule the price is prohibitory.

Oats Grain is much cheaper, and compares favourably with maize and wheat for price, but in feeding with the husks on there is too much indigestible fibre, and the digestive organs are overtaxed with waste.

Ground Oats or hulled oats is free from this handicap, but the price is much higher than maize or wheat normally.

Wheat is a good diet 1 to 6, but it is not a balanced ration in itself, the greatest deficiency being in fats.

Pollard.—The best quality of pollard equals oatmeal in protein, and with maize is the cheapest poultry food in most parts of this State. There are some districts, like Riverina, for instance, where wheat can always be obtained cheaper than maize.

Maize is an excellent food for poultry. Overfeeding with maize is certainly fattening, and is injurious to good results from laying hens, but this competition has demonstrated that maize carefully fed and only in proportion with natural grass feeding, pollard and bran, mash and meat, has no injurious affects, but, on the contrary, gives higher results in egg production. Lewis Wright gives the analysis of maize as 8 in fats, but Bauer gives it as only 5, which makes a considerable difference as to the fattening properties. In an experiment carried out at Massachusetts College, in America, "maize feeding *v.* wheat feeding," maize was found to give the greatest egg production. Of late years maize is becoming more popular every year in poultry feeding in America, while in England it is now but little used. In Denmark, one of the leading poultry and egg producing countries of Europe, maize was formerly used as a general food for fowls, but now it is considered detrimental to their laying qualities, and they are fed on oats and potatoes boiled in waste milk, so says a writer of that country, D. Adhemar, in a pamphlet recently written by him on the Danish egg trade. Their best laying is reputed to be 115 to 120 eggs per annum. The results of our competition demonstrate that it would be unwise for us to be guided by this system of feeding.

General Attention.

The houses are cleaned every Monday morning. The fowls are watered with clean, fresh water every morning, and weekly the utensils are scrubbed out with sand. The shell-grit boxes are kept filled up. The eggs are gathered regularly at 3 p.m. each day, and recorded, and an average weight taken quarterly. All hens in the run are subjected to keen daily observation, to note their health, and to see that they are in their right pens. During the whole time we had no trouble with hens being in the wrong pens.

The precaution of each competitor—cutting one wing of each hen before sending them to the competition, prevents a lot of trouble, in checking them from flying over the fences. The fences are 6 feet high, but unless the wings are cut, the Mediterreanan breeds can easily mount a 6-foot fence.

Laying Competitions and Egg Production.

The question of egg production has been a very important one in Europe, America, and with us for a great number of years. The general trend in breeding effort has been towards practical utility, and now in England and America many associations and societies have been formed for the advancement of general utility in poultry. Mr. Holmes Tarn, a member of the Utility Poultry Club of England, was the originator of the first Egg-laying Competition, 1896. This was the first held in the world. But the English competitions are conducted for only sixteen weeks in the year, from October to February, the winter season, and corresponds with our season April to August. While giving a good record of winter laying, the short duration of the competition leaves too much in the hands of the breeder, and there is luck attached to the winning pen.

The English competition gives points for the size of the eggs. This entails a heavy amount of labour, and the secretary, Mr. W. B. Horne, admits that, while eggs are sold by the number, the Committee hardly see any advantage to be gained.

Laying competitions are becoming general throughout Australia, and no doubt they will do equally as much good as poultry exhibitions. For 1904 we start with 100 pens of six hens each, including seven from America, two from New Zealand, one from Queensland, and one from Victoria.

The competition will be held under the following rules revised and brought right up to date :—

1. The competition to extend over the period from 1st April, 1904, to 31st March, 1905. Competitors to deliver their birds at the Hawkesbury Agricultural College, between the 1st and 24th, March inclusive.
2. Each pen to consist of six pure bred pullets, not less than 7 months or more than 12 months old on 1st April, 1904. No male bird to be included.
3. All birds to be bred by and to be the property of the competitor.

4. The birds upon being accepted by the Poultry Expert, when delivered at the College, as being of suitable age, no protest will be entertained on that point.
5. Any bird found to be suffering from an infectious or contagious disease when delivered at the College to be rejected, and replaced by the competitor.
6. The Poultry Expert is empowered to reject any bird that is not a fair specimen of the breed entered, such bird to be replaced.
7. One wing of each pullet to be cut by the owner before forwarding to the College. The wing to be kept cut during the currency of, the competition.
8. In the event of a bird dying, or becoming diseased or incapacitated from laying through sickness, the competitor will be allowed to replace her.
9. All eggs to become the property of the Department of Agriculture.
10. The competition to be decided by the total number of eggs laid by each pen.
11. Eggs under 1½ oz. in weight, or otherwise unmarketable, not to be counted.
12. Any pen the eggs from which do not attain an average weight of 21 oz. per dozen, after the first three months of the competition, to be ineligible for a prize.
13. The market value from each pen to be recorded, and prizes given for the greatest total value.
14. Prizes to be given for a winter test to extend over the first four months of the competition, and to be restricted to Australian competitors.
15. Records to be kept of the total quantities of the various foods consumed, and the average cost per head.
16. No competitor to be allowed to withdraw any bird until the termination of the competition.
17. The Committee's decision in all matters of dispute to be final.

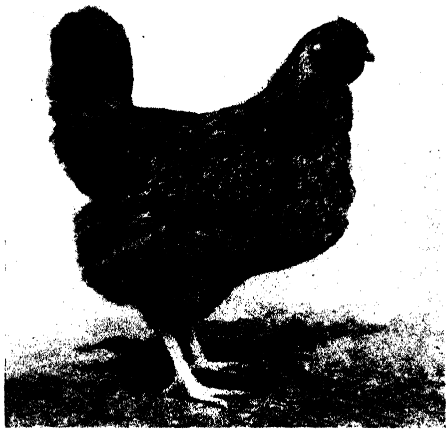
The following is a *résumé* of the recent competition published in the columns of the *Daily Telegraph*, Sydney, on Saturday, 2nd April, 1904:—

EGG-LAYING COMPETITION AT HAWKESBURY AGRICULTURAL COLLEGE

VALUABLE PRACTICAL TESTS—A REMARKABLE SUCCESS, PROVING THAT POULTRY PAYS—PROFIT OF £251 ON 420 HENS.

THE second annual egg-laying competition, organised by the *Daily Telegraph*, and conducted at the Hawkesbury Agricultural College by Mr. D. S. Thompson, Government Poultry Expert, terminated on Thursday last.

Carried out on the most practical lines, so as to afford the best possible object-lesson to poultry-keepers, the competition has evidenced a gratifying advance in every respect on its predecessor; and the results obtained, exceeding as they did the most sanguine expectations, show that utility poultry-keeping in this State has already attained a very high standard. Excellent as the records are, however, it is confidently expected that they will be exceeded in the current competition, which commenced yesterday. The pullets this year are not only of a better average age for early laying, owing to the minimum age fixed by the Committee, but a much greater proportion of them have been specially and carefully bred from proved layers than was the case in the contest just concluded.

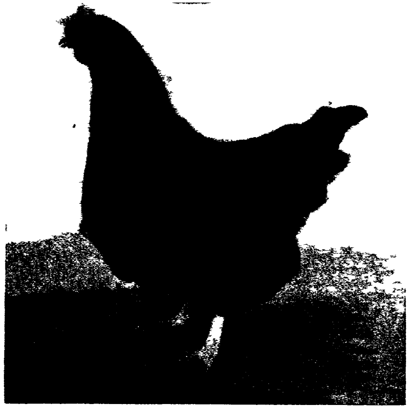


A typical hen from Mr. Warren's pen.

Silver Wyandottes, entered by Mr. R. E. Warren, Richmond.

Winners of the First Prize for greatest number of eggs (1,308) laid during the twelve months and for the greatest market value (£7 10s. 4d.). Sixth Prize for greatest number of eggs laid during first six months (winter), and Second Prize for greatest number of eggs laid during the last three months.

Second International Twelve Months' Laying Competition, Hawkesbury Agricultural College April, 1903–March, 1904.



A typical hen from Mr. Wild's pen.

A typical hen from Mr W. F. Evenden's pen.

Black Orpingtons, entered by Mr. W. Wild, Lake Albert.

Winners of Second Prize for greatest number (1,274) of eggs laid during the twelve months, Eighth Prize for first six months (winter), and Fifth Prize for market value

Andalusians, entered by Mr. W F. Evenden, Kogarah

Winners of the Third Prize for greatest number (1,242) of eggs laid during the twelve months, and Fifth Prize for the greatest number of eggs laid during the last three months

Second International Twelve Months Laying Competition. Hawkesbury Agricultural College April, 1903–March, 1904

The primary object of these competitions is to stimulate systematic breeding for egg-production, and in this respect they are exercising a marked influence. People's eyes have been opened to the fact that strains can be worked up that will lay twice as many eggs as the average hen, and progressive poultry-keepers, both large and small, are now everywhere studying testing, and selecting their breeders with this object in view. With thousands of poultry-keepers, as is now the case, ever striving to equal or excel the standards set by the continuous competitions, it is easy to see that the average hen must gradually reach a higher and higher degree of productiveness, and thus be an increasing source of profit to her owner and the State.

A Tribute to the Experts.

Given the best of hens the maximum results can only be secured by the most skilful and judicious feeding and attention. The same hens will give very different results in the hands of different men. Mr. Thompson and his assistant, Mr. G. Silk, have proved themselves pastmasters in the art of making the hens do their best. It says much for the management that nearly every hen has come through the ordeal in good health, although a few that had not the constitution to stand the strain were literally hustled to death.

The Prize Winners.

The prize money amounted to £102, and was won as follows :—

For the greatest number of eggs in the twelve months :—

	£	s.	d.		£	s.	d.
1. R. E. Warren	15	0	0	7. A. Munro	3	0	0
2. W. Wild	10	0	0	8. J. Rone..	2	10	0
3. W. F. Evenden ...	7	0	0	9. G. Howell	2	0	0
4. C. A. W. Weil ...	6	0	0	10. W. K. Hays	1	10	0
5. Mrs. A. H. Hansel ...	5	0	0	11. Mrs. N. Kirby... ..	1	0	0
6. W. H. Ponton and Son	4	0	0	12. S. Kendall	0	10	0

For the first six months (winter test) :—

	£	s.	d.		£	s.	d.
1. Mrs. A. H. Hansel ...	5	0	0	6. R. E. Warren	2	0	0
2. G. Howell	4	0	0	7. S. Kendall	1	10	0
3. W. H. Ponton and Son	3	10	0	8. W. Wild	1	0	0
4. A. Munro	3	0	0	9. J. Varley	0	10	0
5. W. K. Hays	2	10	0				

For the greatest market value :—

	£	s.	d.		£	s.	d.
1. R. E. Warren	5	0	0	4. W. K. Hays	1	0	0
2. Mrs. A. H. Hansel ...	3	0	0	5. W. Wild	0	10	0
3. G. Howell	2	0	0				

For the greatest number of eggs in the last three months :—

	£	s.	d.		£	s.	d.
1. Cardwell and Messervy, 333	3	0	0	3. Arcadia Poultry Farm, 294	1	10	0
				4. J. Rone, 285	1	0	0
2. R. E. Warren, 294 ...	2	0	0	5. W. F. Evenden, 284 ...	0	10	0

Highest total from any pen for any month :—

J. Rone (160 in August), £2.

The Winning Pen.

Mr. R. E. Warren's winning Silver Wyandottes laid steadily and well from start to finish. At the end of the first six months they stood 6th, but gradually overhauling the leaders, they went to the top at the end of February, and finished with thirty-four eggs to spare. An important factor in their success is that they went right through without breaking into moult, but this must not be allowed to detract from their magnificent record of 218 eggs per hen. To show the value of breeding from proved layers, Mr. Warren states that they were bred from a pen of hens that averaged 214 eggs in a year. Like all the other successful Silver Wyandottes they are smallish in size, and have been moderate eaters throughout. An offer of £50 for the pen has been refused.

The American Pens.

The American competitors have amply justified their acceptance of the committee's challenge to send better layers than those that had been tested here. Two of the three pens from the United States have exceeded by ninety and forty-eight eggs respectively the best record in the first competition, while the three have laid in the aggregate fifty-three more eggs than the three leading pens in the first test. The merit of their performance can only be adequately gauged by those who know in what bad condition the American hens entered the contest after the long voyage, and their achievement is enhanced by the fact that most of the hens moulted three times in the twelve months. Mrs. Hansel's Leghorns are among the classic band of 200-egg hens, and as profit-givers they stand alone, as they produce their great tally of eggs on half the average quantity of food consumed by the whole of the pens. Mr. Hays' White Wyandottes have proved themselves ahead of any pens of the breed yet tested in Australia.

Results compared.

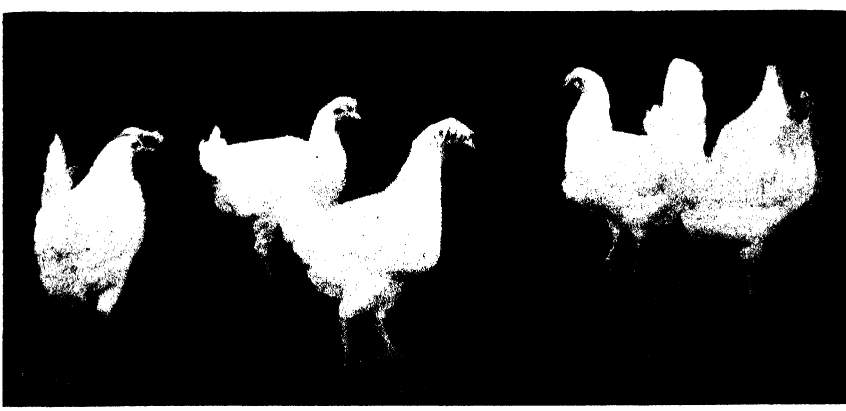
The conspicuous feature of the general success of the competition is that the production per hen increased from 130 to 163 eggs, as compared with the first test. No less than fifteen pens eclipsed the record of 1,113 eggs, with which the Grantham Poultry Farm won first place last year. The following table compares the results of the two competitions:—

	1902-3.	1903-4.
Number of pens	38	70
Winning pen's total	1,113	1,308
Lowest pen's total	459	666
Highest total first six months	548	711
Most eggs from a pen in a month	137	160
Average laying per hen	130	163¼
Greatest value of eggs from a pen	£7/0/3	£7/10/4
Average price of eggs per dozen	1/1	1/3¾
Average value of eggs per hen	15/6	17/9½
Cost of feed per hen	6/-	5/9¾
Profit over feed, per hen	9/6	11/11¾

A comparison of the average egg production and the average value of the eggs per hen of the various breeds is instructive and interesting. As a guide, however, to the relative merits of the different breeds, no significance can be attached to the positions occupied by varieties in which there were only one or two pens competing. The following are the analyses:—

	Per Hen—Eggs.	Per Hen—Value.
6 Rose-comb Brown Leghorns	200·50	24/10½
6 Buff Leghorns	198·33	23/3½
6 Buff Wyandottes	192·66	21/9
6 Anconas	180·00	19/2
12 Langshans	174·75	16/6½
24 Andalusians	173·91	17/4
84 Black Orpingtons	168·07	18/1¾
72 White Leghorns	165·07	17/6½
60 Silver Wyandottes	161·95	18/4
30 White Wyandottes	160·50	18/7
6 Jubilee Orpingtons	160·50	17/3
12 Minorcas	154·25	15/9
60 Buff Orpingtons	148·88	16/3
30 Golden Wyandottes	145·13	15/3
6 Single-comb Brown Leghorns	137·50	13/9½

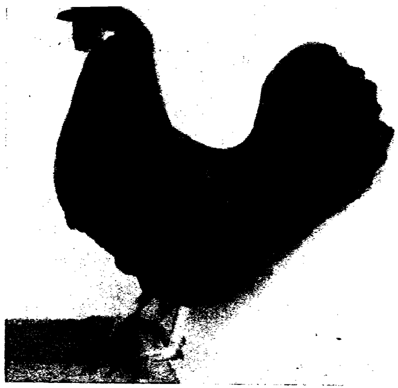
A typical hen from Mr. C. A. W. Weil's pen.



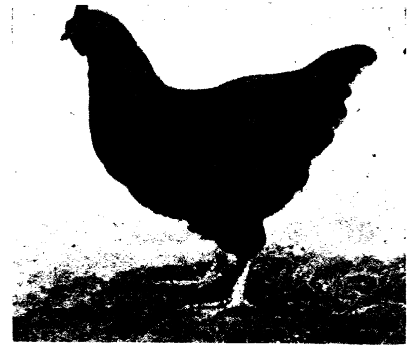
White Leghorns, entered bv Mr. C. A. W. Weil, Ashfield.

Winners of the Fourth Prize for greatest number (1,225) of eggs laid during the twelve months.

Second International Twelve Months' Laying Competition, Hawkesbury Agricultural College, April, 1903-March, 1904.



A typical hen from Mrs. Hansel's pen.



A typical hen from Messrs. W. H. Ponton and Son's pen.

Rose-comb Brown Leghorns, entered by Mrs. A. H. Hansel, America.

Winners of the Fifth Prize for greatest number (1,203) of eggs laid during the twelve months; First Prize for the greatest number of eggs laid during first six months (winter); Second Prize for greatest market value (£7 9s. 4d.)

Langshans, entered by Messrs. W. H. Ponton and Sons, Tuggerah Lakes.

Winners of Sixth Prize for greatest number (1,195) of eggs laid during twelve months; Third Prize for greatest number of eggs laid during the first six months (winter).

Second International Twelve Months' Laying Competition, Hawkesbury Agricultural College. April, 1903–March, 1904.

Mr. Thompson's Review.

"The success of the competition," reports Mr. Thompson, "augurs well for future work in connection with the improvement of the egg production of the State. This work is making good and practical progress as a direct result of the object lessons which these public tests afford.

"Our egg yield showed an enormous increase over that of the first competition, from the following causes: - A more favourable season, improvements in attention and feeding, and last, but not least, by the work of the competitors themselves in improving their laying stock, and in the earlier breeding and maturity of their birds. Notwithstanding that the general average of eggs produced was so much larger than in the first competition, and the totals of the leaders this year are far away ahead of those of last, it is satisfactory to note that competitors, who have taken part in both tests with the same breed, have in most instances improved their production. This is shown by the following comparison:—

	1st test.	2nd test.		1st test.	2nd test.
W. F. Evenden ..	768 eggs	1,242 eggs.	W. B. Bull ...	715 eggs	882 eggs.
A. Munro	804 ,,	1,190 ,,	E. Waldron ...	863 ,,	864 ,,
Mrs. H. Bastin ..	912 ,,	1,086 ,,	J. F Brown ..	945 ,,	857 ,,
W. H. Tombs ...	757 ,,	1,080 ,,	Bosanquet Bros. ...	881 ,,	825 ,,
A. E. Henry ..	1,020 ,,	1,081 ,,	W. Harris	552 ,,	825 ,,
Horwood and Dennis	705 ,,	902 ,,	L. L. Ramsay ...	618 ,,	817 ,,
M. Ward	1,026 ,,	901 ,,			

"So that it is not (with three exceptions) that these competitors have gone back, but that others have done much better than most of them, and two competitors, who were low down last year (Messrs. Evenden and Munro) have gone right up into the front rank.

"The weather throughout was favourable to a good production of eggs. There was plenty of rain, but it was periodic. At no time did we have a spell of wet weather sufficiently long to interfere materially with the laying. The winter months were rather dry, frosty, and cold, and as these frosts were followed by a fairly long period of damp, dull, cold weather well into the spring, the climatic conditions were undoubtedly in favour of the Asiatic varieties, and adverse to the Mediterraneans. During the twelve months, fifteen hens died out of 420, the whole of the deaths being from ovarian troubles.

The System of Feeding.

"The hens have been fed on the simplest diet possible throughout the competition. The morning meal consisted of bran and pollard mash at 7 o'clock. The mash was scalded with liver soup two days a week, and on the other five days it was simply mixed with water, the quantity given being an average of about 1 imperial pint per pen, the big eaters taking considerably over the pint, and the small eaters a little under. In the afternoon, between 4 and 5 o'clock, the hens were grain fed, 1 pint, more or less, according to appetite, of crushed maize, and sometimes wheat. Cut-up liver was given twice a week, at the rate of about 2 oz. per head. Shell grit was always before them, and clean water was given every morning. In the way of green food, rape was fed for three months during the winter, when the grass was withered. For the other nine months the only green food the hens got was the natural grass in the pens. The rape was fed whole in the leaf, at the rate of about a dozen leaves to a pen every second day.

"The grain used consisted almost exclusively of crushed maize throughout the year, This shows the fallacy of the theories of most authorities in England and Australia who condemn maize feeding for laying hens. Americans discovered simultaneously with ourselves that maize is a much neglected poultry food. The demonstration of its value is alone worth thousands of pounds to a maize-producing State like New South Wales. Although we fed successfully on maize alone, we do not advocate feeding on that principle if wheat can be cheaply obtained; but as soon as wheat is higher in price we have no hesitation in using maize exclusively. At equal prices we prefer its use alternatively with wheat, but we prefer good crushed maize to inferior wheat at all times. By inferior wheat we mean any but the best milling grain."

The Financial Aspect.

"The cost of feeding was—

	£	s.	d.
For bran, pollard, and grain	102	18	4
Meat	15	9	4
Green food	2	3	0
Shell grit	1	10	0
Total	122	0	8

"The prices of feed-stuffs fluctuated considerably—pollard from 1s. 8d. to 9½d ; bran from 1s. 4½d. to 7¾d. ; maize from 3s. 9d. to 2s. 6d., and wheat from 6s. to 2s. 6d. per bushel.

The monthly laying was :—

April	1,284 eggs	October	7,834 eggs
May	3,124 ,,	November	6,608 ,,
June	4,821 ,,	December...	6,249 ,,
July	6,636 ,,	January	5,804 ,,
August	8,577 ,,	February	5,103 ,,
September	8,476 ,,	March	4,056 ,,

Grand total, 68,572 eggs, or 5,714 dozen.

The market value of the eggs was £373 15s. 2d., from which deduct the cost of feed, £122 0s. 8d., and a profit of £251 14s. 6d., is left on the 420 hens. Every pen showed a profit on the cost of feed, the pen returning the smallest value leaving a margin of 6s. per hen.

The monthly range of prices for eggs was :—

	s. d.		s. d.		s. d.		s. d.
April	2 3	to	2 6	October	0 11	to	0 11½
May	2 4½	,,	2 7	November .	1 1	,,	1 2½
June	1 10½	,,	2 2	December	1 1	,,	1 4½
July	1 2	,,	1 11	January	1 4	,,	1 5½
August	0 10½	,,	1 2	February	1 4½	,,	1 5
September ...	0 10	,,	0 11½	March	1 6	,,	1 9½

Some of the Lessons derived.

The test has demonstrated that with close attention and constant work egg production will pay well.

That good results can be obtained from the plainest food, and that maize can be fed largely with good results.

That hens will lay better without than with males, and at less expense.

That the smaller the flock in each pen the better the results will be.

That hens must not be allowed to go broody if a large production of eggs is to be obtained.

That winter-laying varieties will pay the best. Of this no better illustration can be given than that while C. Weil's pen of White Leghorns are forty-five eggs ahead of G. Howell's Silver Wyandottes in the aggregate, they are no less than £1 behind them in the value of the eggs produced. Multiply these figures by 100, which will give for 600 Weil's hens (the number of hens in the third competition), 4,500 eggs ahead of Howell's, while the latter would pocket £100 more money than Weil, though gathering and marketing 4,500 eggs less.

In fact, the whole competition is a revelation in the way the Asiatic bloods not only practically carried everything before them as winter layers, but have invaded the stronghold of the Mediterranean breeds, and have beaten them right through for summer and winter laying combined, not only in value but in numbers as well, a fact which, if asserted a few years ago, would have been held up to ridicule.

The Records.

The appended table gives full details of the laying and the value of eggs from each pen of six hens. The value has been calculated on the basis of the prices obtained for best new-laid eggs at the auction sales in Sydney each Friday. The age given is the average of the six birds at the commencement of the competition.

Owner, Address, and Breed.	Age—Months.	Eggs Laid. April.	May.	June.	July.	August.	September.	October.	November.	December.	January.	February.	March.	Totals.	Weight per doz.	Market value.
															oz.	
1. R. E. Warren, Richmond: Silver Wyandottes	9	72	80	76	121	142	126	126	134	136	97	93	105	1308	24	150/4
2. W. Wild, Lake Albert: Black Orpingtons	7½	33	80	110	108	131	136	149	136	131	101	85	74	1274	25	143/1
3. W. F. Evenden, Kogarah: Andalusians	7	1	58	101	128	140	145	147	119	119	102	98	84	1242	25½	134/6
4. C. A. W. Weil, Ashfield: White Leghorns	7½	20	32	61	119	145	144	151	144	135	119	94	61	1225	27½	128/1
5. Mrs. A. H. Hansel, America: R. C. Brown Leghorns	17	103	130	127	110	117	124	119	122	96	53	49	53	1203	24	149/4
6. W. H. Ponton and Son, Tuggerah Lakes: Langshans	7	15	91	115	139	145	142	114	99	96	70	99	70	1195	26½	136/3
7. A. Munro, Rockdale: Buff Leghorns	6	61	97	112	113	132	123	123	107	106	94	75	47	1190	25½	139/8
8. J. Rone, Riverstone: Black Orpingtons	6	0	1	101	145	160	156	117	104	113	115	96	74	1182	26½	122/9
9. G. Howell, Wentworthville: Silver Wyandottes	7	96	137	106	112	110	132	106	51	84	93	91	62	1180	24½	148/3
10. W. K. Hays, America: White Wyandottes	11½	86	116	100	112	114	101	99	91	84	82	95	81	1161	26	147/8
11. Mrs. N. Kirby, Ryde: Buff Wyandottes	9	10	60	129	124	123	133	115	99	95	88	85	95	1156	23	130/5
12. S. Kendall, Kiama: Silver Wyandottes	7	5	70	116	126	145	142	121	69	84	95	78	101	1152	24	128/7
13. Elphinstone Bros., Eastwood: Minorcas	8	15	42	78	78	125	141	145	124	125	118	87	50	1128	27	120/3
14. A. Wedlich, Caulfield (Vic.): Black Orpingtons	7	11	51	95	110	131	132	125	111	98	111	72	77	1124	26	123/-
15. A. Arnold, Ashfield: White Leghorns	6½	1	39	93	128	135	133	131	99	115	85	95	68	1122	29½	121/-
16. C. H. Wickham, Roseville: Black Orpingtons	11	19	59	85	82	137	122	110	101	105	81	71	129	1101	23½	123/9
17. H. R. Harris, Neutral Bay: Black Orpingtons	5	0	41	70	140	150	137	128	85	91	97	87	71	1100	27	118/-
18. Mrs. E. Scaysbrook, Gosford: Black Orpingtons	11½	15	46	101	124	121	120	128	103	112	82	86	57	1100	27½	120/8
19. J. Ahern, Arncliffe: Silver Wyandottes	7½	15	76	107	114	150	119	106	81	83	79	78	103	1091	25	125/1
20. F. S. Fuller, Kiama: White Leghorns	6¾	22	60	90	121	137	143	118	104	87	73	88	48	1091	25½	121/-
21. Mrs. H. Bastin, Enfield: Black Orpingtons	7	37	61	104	101	122	121	120	101	82	92	79	66	1086	24	123/7
22. A. E. Henry, Ryde: Silver Wyandottes	8	75	75	68	106	115	114	108	79	77	95	88	81	1081	24	129/-
23. W. H. Tombs, Penrith: Anconas	7	39	54	42	98	139	145	137	129	108	91	61	37	1080	25	115/2
24. Grantham P. Farm, Plumpton: White Leghorns	6	0	13	58	74	143	140	151	124	118	97	114	46	1078	26	107/5
25. C. F. Agst, Mulgrave: White Leghorns	5½	4	60	77	109	133	129	127	105	113	89	78	49	1073	29	116/-
26. Arcadia P. Farm, Arcadia: White Wyandottes	6	0	37	95	103	103	138	115	78	99	101	91	102	1072	23	117/-
27. J. Varley, Rookwood: Buff Orpingtons	7	37	102	102	108	136	112	85	69	81	76	96	57	1061	28	127/1
28. H. S. Bignell, Bandon Grove: Golden Wyandottes	6	0	34	87	114	136	124	112	99	90	77	90	84	1047	26	122/3
29. Cardwell and Messervy, Leichhardt: White Leghorns ..	6	0	1	14	41	102	126	134	131	134	130	122	81	1016	27	99/9
30. E. Lomax, St. Leonards: Black Orpingtons	7	52	44	30	68	141	134	129	93	94	76	97	58	1016	27	110/1
31. J. J. Roche, Bayview: White Leghorns	7	37	84	48	90	140	133	121	106	94	79	50	27	1009	28	112/8
32. Browne and Jervis, Bowral: Andalusians	4½	0	0	9	104	138	128	133	125	110	128	75	54	1004	28½	96/3
33. Mrs. A. J. Evenden, Bexley: Andalusians	7½	26	48	47	87	124	125	132	125	129	95	54	4	996	26	103/-
34. C. T. Burton, Hurstville: Buff Orpingtons	8	6	61	91	95	119	119	79	104	59	98	79	84	994	26½	111/7
35. H. G. Lambert, Moss Vale: Buff Orpingtons	6½	10	69	66	132	145	116	107	48	68	76	61	82	980	26½	109/1

Owner, Address, and Breed.	Age—Months.	April.	May.	June.	July.	August.	September.	October.	November.	December.	January.	February.	March.	Totals.	Weight per doz.	Market value
		Eggs Laid.													oz.	
36. C. Bridekirk, Enfield : White Leghorns	6½	20	44	39	75	125	128	128	108	92	78	85	43	965	27	101/3
37. W. Gibson, Penrith : Jubilee Orpingtons	6	0	31	95	122	135	131	103	74	79	83	45	65	963	26½	103/6
38. Mrs. Widmer, Drummoyne : Orpingtons	7	4	39	118	116	135	133	112	75	66	59	53	39	949	26	103/4
39. E. Butcher, North Sydney : Black Orpingtons	8½	21	48	93	87	113	126	95	85	77	74	54	63	936	27½	104/6
40. D. Frewin, Gosford : Andalusians	6½	14	79	59	76	107	122	117	104	100	72	64	13	932	27	102/-
41. E. H. Maxwell, East-hills, White Leghorns	6	17	35	41	51	80	123	137	125	135	110	69	7	930	29¼	97/-
42. Horwood and Dennis, Wagga Wagga : White Leghorns	8	18	26	46	97	134	131	122	107	71	83	38	29	902	28¾	92/9
43. E. J. Winton, Campbelltown : Langshans	6	0	32	92	108	112	105	113	97	61	69	53	60	902	26	98/2
44. M. Ward, Thornleigh : Black Orpingtons	5½	0	37	74	97	133	109	108	90	84	81	63	25	901	26¾	96/7
45. F. Dahlgren, Narara : Buff Orpingtons	9	0	30	103	92	123	111	95	78	75	57	65	64	893	25½	97/1
46. L. A. Wallace, Goulburn : Black Orpingtons	7½	0	19	79	68	131	98	110	63	93	97	64	65	887	25	94/3
47. W. B. Bull, Summer Hill : White Wyandottes	9	34	46	34	70	106	116	98	85	57	81	80	75	882	26	95/9
48. W. Frame, Canterbury : Buff Orpingtons	10	0	1	41	80	133	136	96	85	79	61	91	74	877	27	86/4
49. W. B. Candee, America : White Wyandottes	11	103	94	68	80	74	71	69	64	68	68	61	55	875	25¼	111/7
50. E. Waldron, Willoughby : Black Orpingtons	7	4	8	27	72	120	121	116	101	90	92	69	44	864	25½	86/3
51. J. E. Pemell, Randwick, Golden Wyandottes	7	0	11	51	108	112	116	91	94	75	73	70	61	862	25¾	99/9
52. J. F. Brown, Summer Hill : Silver Wyandottes	6	0	0	61	126	139	116	107	86	80	49	39	54	857	27¾	87/9
53. R. Newell, Petersham : Golden Wyandottes	6	0	0	50	79	105	119	90	87	85	81	85	64	845	24½	85/2
54. A. Beattie, Blackwall : Buff Orpingtons	8¾	17	36	61	78	110	114	93	75	70	72	59	41	831	28	89/3
55. Bosanquet Bros., Liverpool : Buff Orpingtons	6	0	47	61	79	100	92	82	78	79	63	69	75	825	24	90/5
56. W. Harris, Woy Woy : White Wyandottes	7	18	10	32	69	93	101	98	67	78	90	87	82	825	23¼	85/2
57. Mrs. J. Jubb, Pambula : Brown Leghorns	4½	0	26	32	52	126	120	115	106	83	64	63	38	825	26¼	82/9
58. A. Hallen, Toongabbie : Golden Wyandottes	6	20	59	50	58	120	104	99	71	65	69	47	56	818	24½	91/1
59. L. L. Ramsay, Carlingford : Black Orpingtons	6	6	39	64	77	106	134	75	89	65	66	63	33	817	27	86/9
60. J. D. Parmenter, Berrima : Silver Wyandottes	7	9	23	57	123	113	85	87	84	62	70	48	54	815	26	87/9
61. A. T. Tipping, Burwood : White Leghorns	7	0	43	60	74	106	112	119	96	76	69	31	26	812	30½	85/3
62. W. H. Lathlean, Waratah : Silver Wyandottes	8	15	46	45	96	132	92	90	41	74	71	56	34	792	24½	87/2
63. H. Cadell, Epping : Buff Orpingtons	6½	0	11	36	49	124	94	98	85	86	79	60	61	783	25	78/4
64. A. E. M'Leod, Hermidale : Golden Wyandottes	6½	0	0	6	85	118	125	91	80	73	72	84	48	782	25½	76/2
65. C. R. Smith, Croydon : White Leghorns	7	14	24	20	23	102	135	116	117	66	82	57	5	761	27½	74/4
66. J. E. Robberds, Artarmon : Silver Wyandottes	4½	0	0	56	119	112	85	80	80	77	61	57	48	775	24	81/9
67. C. H. Bayley, Croydon : Buff Orpingtons	7½	8	32	77	66	82	109	86	73	57	63	51	36	740	24	82/5
68. Mrs. A. P. Lombe, Ashfield : Black Orpingtons	5	0	0	10	84	128	108	69	100	66	64	84	17	730	24	71/-
69. D. B. Bannister, Pymble : Minorcas	6	0	3	23	24	92	107	106	109	106	88	61	4	723	29	68/7
70. T. Bourne, Moss Vale : Silver Wyandottes	7½	19	36	49	76	85	92	37	47	55	58	41	71	666	26½	75/6

A Comparative Test in Feeding Calves.

H. P. SUTER,
Dairy Instructor, Hawkesbury Agricultural College.

At the request of Messrs. Denham Bros., Sussex-street, Sydney, and by direction of the Hon. the Minister of Agriculture, a test of the feeding value of cod-liver oil on calves in comparison with the ordinary College ration has been conducted recently, and the data gathered are now recorded.

To administer cod-liver oil in any form to man or animals, generally conveys with it the impression that it is a combination of food and medicine. Long before any medicinal value was attached to the use of cod-liver oil, we are aware that its value as an article of food was fully known and appreciated by the Greenlanders, Laplanders, and Esquimaux. Of late years, however, its virtues have been largely extolled as a remedy where defective nutrition is indicated, or as a food least likely to risk the disturbance of the digestive apparatus. The oil recently placed on the market is sold at a price which enables it to be used with advantage in the rearing and feeding of stock. The quality is such as to cause it to be readily digested; and its palatable character is not affected.

Eight calves, four each bull calves and heifers, were selected, about three months old—Crossbred Dexter-Kerry, Shorthorn, Ayrshire, and Red Poll, with the Ayrshire blood predominating. We may class them as ordinary grade stock.

The test commenced on Monday, 11th January, 1904, when the calves were all weighed and registered one hour after feeding. Throughout the test, this method was followed each Monday. The calves were permitted to graze in a small paddock sparsely-grassed with couch (*Cynodon dactylon*, Pers.), and they had free access to water. The ordinary College ration for calves that age for one day is:—8 oz. pollard, 4 oz. copra cake, 2 oz. molasses, 3 gallons skim milk (centrifugal). This combination has a nutritive ratio of 1 to 4·6.

In preparing this ration, the copra cake, or cocoanut oil-cake, was soaked over-night in water. The following morning it was mixed with the pollard, molasses, and water, and boiled for half to one hour, until it reached a thickness the consistency of cream. It was then mixed with the skimmed milk and fed to the calves at a temperature about 98° F. The treatment the calves had from birth was: On being removed from the dam the first day after calving the animal was given colostral milk or beestings warm for one week. The following two weeks equal parts of full and skimmed milk—one gallon each day—after which they were fed on the College ration, which we will term A ration. The cod-liver oil ration will be termed B, and consisted of—

2 fluid ounces cod-liver oil.
3 gallons skimmed milk (centrifugal).

This has a nutritive ratio of 1 to 2·2, albumenoids to carbo-hydrates. The calves, in so far as condition and health were concerned, started

on fairly equal terms and equal in sex. Each ration was divided daily into two meals, and fed at a temperature approximately 98° F., at 8 to 9 a.m. and 3 to 4 p.m. The first day the calves exhibited a disinclination for the B or cod-liver oil ration, but after the fourth feed they took to it readily. They evidently did not care for the odour of the oil.

At the end of the sixth week we were enabled to give the results as follows:—

SUMMARY OF RESULTS showing the weekly increase of weight on four calves fed on ration B (cod-liver oil):—

No. of Calf.	Weight on Jan. 11.	Weight end of 1st week.	Weight end of 2nd week.	Weight end of 3rd week.	Weight end of 4th week.	Weight end of 5th week.	Weight end of 6th week.	Total increase in 6 weeks.
	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.
1 ...	156	165	167	182	193	197	221	65
2 ...	141	154	158	171	183	188	214	73
3 ...	108	127	122	138	150	156	163	55
4 ...	101	109	123	129	134	142	147	46
Total ...	506	555	570	620	660	683	745	239

The average percentage of increase per calf was 47·2. The average increase in live weight of each calf each day was 1·42 lb. It may here be mentioned, that when introducing a cod-liver oil ration to calves, it is good practice to commence with ½ oz. (fluid) of cod-liver oil per meal, and gradually increase it to 2 fluid ozs. It was noticed that as the calves approached the completion of the test, the appearance of the coats was distinctly improved, being sleek, glossy, and clean, with a good healthy look. Throughout the test there was an entire absence of scours or other dietetic disturbance.

SUMMARY OF RESULTS showing the weekly increase of weight on four calves fed on ration A.

No. of Calf.	Weight on Jan. 11.	Weight end of 1st week.	Weight end of 2nd week.	Weight end of 3rd week.	Weight end of 4th week.	Weight end of 5th week.	Weight end of 6th week.	Total increase in 6 weeks.
	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.
5 ...	130	136	139	149	151	154	170	40
6 ...	163	170	169	185	190	196	209	46
7 ...	131	134	136	143	148	153	173	42
8 ...	132	137	141	149	157	159	162	30
Total ...	556	577	585	626	646	662	714	158

The average percentage of increase per calf was 28·4. The average increase in weight of each calf each day was ·94 lb. These calves had a satisfactory appearance, but contrasted with those fed on cod-liver oil, they had dried and harsher looking coats, and did not show the degree of thickness or firmness of the calves fed on ration B.

The food consumed and cost during the test with ration B was—

Cod-liver oil, 84 oz. cost	23·62 pence.
Skimmed milk (centrifugal) 126 gallons @ ½d gal.... ...	63·0 ,,
	86·62 ,,

Cost of food per lb. of gain in live weight was 1·44 pence.

The food consumed and cost during the test with ration A was—

Pollard, 21 lb., cost	9·45 pence.
Copra, cake 10½ lb., cost	5·43 ,,
Molasses 6 lb., cost	2·57 ,,
Skimmed milk (centrifugal) 126 galls. ...	63·00 ,,
	80·45 ,,

Cost of food per lb. of gain in live weight was 2·03 pence.

The prices on which these returns are computed were—

Skimmed milk (centrifugal) ½d. per gallon.
Cod-liver oil in 40 gall. casks, 3s. 9d. per gallon.
Pollard, 9d per bushel.
Copra cake, £4 15s. per ton.
Molasses, £4 per ton.

Conclusions.

It will be seen from the foregoing details that the calves fed on ration B gained 1·42 lb. of live weight per day at a cost of 1·44 pence for each pound gained.

This ration is easily fed, and entails little labour in its preparation and mixing. The calves relished the food, and appeared in better condition at the end of the test.

The animals fed on ration A gained ·94 lb. per day live weight at a cost of 2·03 pence for each pound gained.

This ration requires more attention to prepare, and the calves did not thrive so well.

The evidence is distinctly in favour of the cod-liver oil ration, both in the cost of ration and in the increase in weight, as well as in the time employed in preparing and feeding the ration. This form of ration can be fed with Clarke's Patent Calf Feeder.

Hawkesbury District Farm Notes.

H. M. POTTS.

Wheat.—The sowing of wheats may be continued this month, and all operations completed. The varieties recommended in last month's notes should be sown.

Oats.—The Algerian oat suits this district best. Owing to its vigorous and robust habit it seems better enabled to resist rust. Naturally, it is not so fastidious as wheat or barley, and will thrive on a poorer soil, and with less cultivation, although it has been proved

by experiment that the oat is a gross feeder when fed with nitrogenous manures, to which it readily responds. The value of the oat crop for green fodder and hay, in this district, is important.

Barley.—For the growth of grain the sowing of barley should be finished early in the month. Select good plump seed. Owing to its very rapid growth and early maturing, particularly in sunny situations, this crop may be subjected to a sudden check through too much moisture, and it is possible this may be the case this winter, hence do not rely on one crop. It forms an excellent green fodder for dairy cattle, and can be well grown with other crops, such as oats, vetches, or peas. A well prepared seed-bed is essential for barley. It should be deeply and thoroughly pulverised. It requires a fairly rich soil. The roots grow near the surface and need a soluble form of manure.

Lucerne and Clover.—During the early part of the month sowings of lucerne may be made, if the soil be in good order and not too moist.

Crimson Clover.—Also may be sown.

Rye.—The value of this crop for poor light, loose, sandy soils has not been fully recognised. It will thrive on land found unsuitable for wheat, barley, or maize. It requires less nitrogen for its growth than other cereals, and hence is less exhaustive to soil. It furnishes an abundance of green forage in early spring, and is more certain in developing, seeing it is more robust in character, and withstands frost better than wheat. It grows more rapidly and hardier—certainly barley and oats yield a softer and better class of fodder, but rye may be grown under much harsher conditions. In addition to its usefulness as a green crop for dairy stock it may be grown for grain. The straw is long and unbroken. It is claimed that when grown as a mixture with wheat it exerts a healthy influence in the growth of both plants, particularly in enabling the wheat to resist disease. When laying down grass rye forms a good crop to protect it. The grain is less nutritious than wheat, but the bran and rye is richer in protein. For pig-feed it is valuable. The preparation of the seed-bed should be similar to that of wheat. Two bushels to the acre drilled will be sufficient seed. During this month the crop should be sown for green feed. The variety known as Emerald is the best.

Onions.—Should be largely sown. The recent moist weather is very favourable for quick germination and growth. A firm seed-bed is the best, and the soil brought to a fine tilth.

Carrots and Parsnips.—Small sowings can still be made this month. The growth of these crops might be more utilised for feeding stock. It is surprising how both horses and cattle relish this class of root crops. It forms a healthy and palatable change to other foods, and this factor is not always fully realised or estimated.

Sweet Potatoes and Artichokes.—Should be dug and stored. If required for seed they should be kept under cover and buried in dry sand or fine road dust.

Wheats at Bathurst Experimental Farm.

SEASON 1903–4.

R. W. PEACOCK.

Variety.	Date Sown.	Quantity of Seed per acre.	Date Harvested.	Yield per acre.	Rainfall during growth.	Rainfall for year.	Remarks.
			PADDOCK NO. 2.				
	1903.	lb.	1903.	bus. lb.	inches	inches	
Steinwedel	17 April..	37	12 Dec...	33 30	14·62	21·68	
Bobs	17 ,, ..	36	14 ,, ..	33 13	14·62	21·68	
Hudson's Early Purple Straw.	18 ,, ..	36	19 ,, ..	26 5	14·62	21·68	Germinated badly, and for this reason not comparable.
Zealand	20 ,, ..	36	25 ,,	23 32	16·52	21·68	
Power's Fife	20 ,, ..	34	24 ,, ..	27 6	16·52	21·68	

No manure used on this paddock.

Variety.	Date Sown.	Quantity of Seed per acre.	Date Harvested.	Yield per acre.	Rainfall during growth.	Rainfall for year.	Remarks.
			PADDOCK NO. 3.				
	1903.	lb.	1903.	bus. lb.	inches	inches	
Steinwedel	30 April..	39	15 Dec...	39 57	12·71	21·68	
Cumberland	1 May ..	41	16 ,, ..	37 39	12·71	21·68	
Schnieder	1 ,, ..	39	17 ,, ..	33 30	12·71	21·68	
Jonathan	1 ,, ..	41	17 ,, ..	27 45	12·71	21·68	Very tough to thresh.
Sussex	1 ,, ..	35	17 ,, ..	30 53	12·71	21·68	
John Brown	1 ,, ..	35	17 ,, ..	31 9	12·71	21·68	
Tarragon	1 ,, ..	39	17 ,, ..	31 35	12·71	21·68	
Plover	2 ,, ..	35	18 ,, ..	29 31	12·71	21·68	
Cleveland	2 ,, ..	35	18 ,, ..	35 57	12·71	21·68	
White Hogan ..	2 ,, ..	41	19 ,, ..	29 15	12·71	21·68	
Zealand	2 ,, ..	35	19 ,, ..	27 24	12·71	21·68	
Australian Talavera..	2 ,, ..	41	19 ,, ..	32 43	12·71	21·68	

No manure used on this paddock.

MISCELLANEOUS.

Variety.	No. of Paddock.	Area.	Date Sown.	Date Harvested.	Yield per acre.	Remarks.
		acres.	1903.	1903.	bus. lb.	
Hudson's E.P. Straw	21	17½	26 Mar...	8 Dec...	16 47	Germinated badly.
Lambrigg White Lammas.	20	10 2/20	3 April..	10 ,, ..	16 54	
Steinwedel	20	10 2/25	6 ,, ..	5 ,, ..	25 30	These wheats were manured with 1½ cwt. of superphosphate, No. 2, per acre.
White Hogan ..	17	5	5 May ..	17 ,, ..	25 14	(as above)
White Lammas ..	17	4	5 ,, ..	25 ,, ..	33 6	(as above)
White Tuscan ..	17	1	6 ,, ..	24 ,, ..	32 31	(as above)
				1904.		
Hudson's E.P. Straw	6	9	5 June..	2 Jan. ..	34 42	This area was manured, it being used in a manure experiment in 1902. No manure was applied 1903.
Steinwedel	6	4	4 ,, ..	2 ,, ..	28 45	No manure used.
Steinwedel	4	8	16 ,, ..	9 ,, ..	29 2	This area was manured, it being used in a manure experiment.
				1903.		
Bobs	17	2	8 May ..	16 Dec...	20 43	This area was manured for experiment.
Jonathan	17	2	6 ,, ..	19 ,, ..	22 42	This was a thick and thin seeding experiment.
Headlands	3	8	......	......	30 50	

TOTALS.

Total Area Sown.	Total Yield.	Average Yield per Acre.
99 acres.	2,634 bushels 33 lb.	26 bushels 36 lb.

Notes.

THE varieties in paddock No. 2 are strictly comparable, excepting for Hudson's Early Purple Straw, which germinated badly. The reason for such is difficult to explain, but I have frequently noticed that grain of this variety, grown under droughty conditions, germinates badly.

As will be noticed by reference to the rainfall, the season was favourable, and although the total rainfall is about 3 inches below the average for the district, the distribution was satisfactory and such as to ensure good yields from the earlier-maturing varieties.

These varieties are typical of some of the most important groups which are under general cultivation, and include also a number of new cross-breds.

The following remarks should prove helpful in the choice of varieties for the varied conditions throughout the State:—

Reference to the date of harvesting will afford a guide as to the seasons of the varieties.

Steinwedel is a variety possessing many faults and also a few good qualities. Under favourable conditions it is one of the heaviest yielders. So far, I have found it the most drought-resistant of the bread-wheat varieties, and for this reason is one of the best for sowing for grain or hay in the semi-arid districts. It does not hold its grain well, and is more suitable for harvesting with the binder than with the stripper. It is also rust and bunt liable, and produces a rather weak flour.

Bobs.—One of the most pleasing features of the experiment is the yield obtained from this variety which was produced by Mr. Farrer. In point of yield it proved practically on a par with Steinwedel; as regards earliness it came in two days later. The season, being a favourable one, its drought-resistance was not on trial. It is comparatively rust-resistant, it being almost immune when grown amongst many other varieties which were badly infected. According to experiments carried out by Mr. Farrer, its flour strength lies between the weak and strong flour varieties, and is very much stronger than Steinwedel. I consider it the best all-round variety for conditions similar to those obtaining at this farm during this season.

Hudson's Early Purple Straw.—This variety is one of the best in point of yield of the Purple Straw group. It is very rust liable; it holds its grain better than Steinwedel; it produces comparatively weak flour; it withstands drought fairly well, but in this respect cannot compare with Steinwedel, nor is it as early.

Zealand.—This variety belongs to the Lammas group. It is rather a long season variety and rust liable. It produces a long straw, and is suitable for making into hay. It is not as drought-resistant as the purple straw varieties.

Power's Fife.—This is a variety producing a very strong flour, and is typical of those which have been grown as Manitobas. Its high flour strength makes it valuable for mixing with the ordinary white

Australian wheats. Throughout this season such wheat has been selling at 6d. per bushel advance on the white wheats. Taking 2s. 6d. as the value of Steinwedel, and 3s. the value of Power's Fife, the yield of Steinwedel would amount to £4 3s. 9d. per acre and that of Power's Fife to £4 1s. It is very desirable that such wheat should be grown in suitable districts, such as the cooler portions of the State. In the drier districts the yields are disappointing.

In paddock No. 3 a number of new varieties bred by Mr. Farrer were tested. Some of them are promising varieties, and experiments will be continued with them—they being Cumberland, Schnieder, Sussex, John Brown, Tarragon, Plover, and Cleveland. Jonathan is also a crossbred of Mr. Farrer's, reputed to produce a flour of intermediate strength. It is difficult to thresh, it holding its grain too firmly, a considerable waste resulting in the threshing and winnowing.

White Hogan.—This variety is from a strain of White Hogan selected by Mr. Farrer, and has proved superior to other strains at this farm. It is very suitable to make into hay, and is valuable for this purpose for the cooler parts of the State.

Australian Talavera.—This variety is also serviceable as a hay wheat. It is also one of the best of the Lammas group, withstanding a fair amount of hardship. It and Zealand withstand rust better than some others of the group, and is very serviceable for the table-lands.

All the varieties were sown with the seed drill.

The results obtained under the heading of miscellaneous will be published later in conjunction with the various experiments. Thoroughly cleaned and graded seed of these varieties can be obtained at the farm for 4s. per bushel.

Bokhara Clover.

Mr. W. T. Nixon, of Deeside, Thirlmere, sends the following report as to the growth of Bokhara Clover at his place :—

The sample forwarded is from seed sown with some mixed grasses in a bush paddock. The seed was lightly chipped in where the light heaps of undergrowth had been burnt off, and this, right among the young saplings. Some of the clover plants came up through a clump of undergrowth that shot up after the land was partly cleared, and the plants reached the height of 10 feet, seeming to thrive amongst the undergrowth of saplings. Most of the clover was eaten down by horses and cows, which seem to relish it, and I shall note the undergrowth from the eaten stalks. I have some roots harvested which measure over 9 feet long.

Australian Butters in England.

THE following criticisms by Mr. C. C. Lance on the flavour, texture, make, &c., of various Australian butters on their arrival in London will be of deep interest to our butter factory managers, and to all interested in the dairying industry. I would suggest that next year each factory sending butter to England on its own account should empower the Minister for Agriculture to ask Mr. Lance to forward as often as possible a similar criticism on each brand of butter—the report to be confidential, and to be given only to the factory concerned.—M. A. O'CALLAGHAN.

BUTTER REPORT, 4TH MARCH, 1904.

Butter ex R.M.S. *Omrah*. Arrived London, 29th February, 1904.

No.	Packing.	Flavour.	Make.	Colour.	Salting.	Condition.
1	Should be more careful.	Fair; rather coarse.	Fair texture...	Correct	Correct	
2	Good	Off; tending to rancidity.	Poor texture...	,, ...	,, ..	Heated.
3	Do	Good	Good texture..	,, ...	,,	
4	Not well finished..	Irregular, common; some fishy.	Fair texture...	,, ...	,,	
5	Good	Irregular; mostly good; some common and greasy.	Good texture..	,, ...	,,	
6	Do	Good	,, ,, ...	,, ..	,,	
7	Should be better; not rolled.	Bad; rancid ...	Fair texture...	,, ...	,,	
8	Fair	Good... ...	Not worked enough.	,, ...	,, ...	Heated.
9	Very badly got up	Bad; stale and rancid.	Fair texture..	,, ...	,, ...	,,
10	Not well got up; paper too thin.	Bad; stale and slightly rancid	,, ,, ...	,, ...	,,	
11	Not well finished..	Common; slightly off.	Good texture..	,, ...	,, ...	Signs of heating.
12	Not good; some boxes have quantity of preservative on paper, injuring flavour and colour; paper too thin.	Irregular; some fair, some common and tallowy.	Irregular; mostly fair texture.	,, ...	,, ...	Heated.
13	Not well finished; paper too thin.	Fair, rather common; rancid outside.	Fair texture...	Too high	,, ...	Heated.
14	Fair	Common ...	Good texture.	Correct	,,	
15	Badly finished ...	Bad, stale, and common.	Fair texture ..	,, ...	,, ...	,,
16	Good	Good	Good texture.	,, ...	,,	
17	Not well got up ...	Fair	Fair texture...	,, ...	,, ...	,,
18	Good	Good	Good texture.	,, ...	,,	
19	Should be better; not rolled.	Fair; rather common.	Fair texture...	,, ...	,,	

BUTTER REPORT—*continued.*

No.	Packing.	Flavour.	Make.	Colour.	Salting.	Conditions
20	Good	Fair; rather common.	Fair texture...	Correct	Correct	
21	Should be better; not rolled.	Good	Good texture.	,, ...	,,	
22	Correct	Irregular; common; some fishy.	,, ,, ...	Too high	,, ...	Signs of heating.
23	Do	Mostly fair, but irregular.	,, ,, ...	Correct	,, ...	Evidence of heating in transit.
24	Good	Tallowy ...	Fair texture...	,, ...	,,	
25	Do	Tallowy and common; slightly fishy.	,, ,, ...	,, ...	......	
26	Do	Good	Good... ...	,, ...	Correct	
27	Do	Excellent; very even.	Good texture, but more moisture than usual.			
28	Should be improved	Fairly good; off on outside	Good texture.	,, ...	,, ..	Evidence of heating in transit.
29	Good	Improved; irregular; out of five boxes, one good, four more or less fishy.	,, ,, ...	,, ...	,, ...	

DAIRY LEGISLATION.

OUR competitors for the English butter market in Europe, Asia, and America are all moving ahead, aided by their governments and by wise legislation. We are told that in Siberia, where the first butter on modern lines was made by an English woman married to a Russian, dairying has now become the chief resource of the peasants, and the chief industry of that country from the point of view of international trade. Yet, ten years ago, Siberian butter was unknown. The Russian Government built the great Siberian railway, thus opening up the country to commerce, and by arranging for the proper education of the settlers in dairying, by a plentiful supply of instructors, they placed the industry on a sound and improving basis. The addition of a special railway and steamer service completed the commercial connection, and Siberian butter is now an important factor on the London market. Their export season is generally from May to August. As a further stimulus, however, the Russian Government recently decided to subsidise the industry to the extent of two million roubles (equal to about £366,666), and attempts are being made to found co-operative associations on the same lines as the Danish societies. This will have the effect of giving a greater uniformity, as well as an improvement in quality.

The Canadians have for years been making steady progress with their dairy products on British markets, and they have now come forward with an Act of Parliament that will jealously guard the reputation and purity of their butter. This Act specially prohibits the importation and manufacture of any butter substitutes, whether milk-blended butter or margarine. It also prevents the manufacture of butter containing more than 16 per cent. water. The measure also guards against the misuse of the word "creamery" as applied to butter. This is a very useful provision, as it will prevent milled dairy and factory butters being exported as "finest creamery."

I have before me a copy of the English Butter Bill, which seems, to a great extent, on all fours with the Canadian Act. Both are of deep interest to our farmers, and when they read their clauses I hope they will bear in mind the fact that they are absolutely unprotected from the practices which the British Bill and the Canadian Act have been introduced to prevent; also that these provisions were contained in the recent Dairy Bill which so many of them failed to support.

M. A. O'CALLAGHAN.

Farm Notes.

BATHURST DISTRICT.—May.

R. W. PEACOCK.

Wheat.—As the soil is getting colder, the wheat sown during this month will not grow as quickly as that sown during April; during which month the bulk of the crop should have been put in. The richer warmer soils can be sown to better advantage than the poorer during this month. The quantity of seed per acre should be increased over that used in earlier sowings, as the plants will not stool so freely. A dressing of 1 cwt. of superphosphate per acre would materially assist the growth, it being proved that crops so treated mature earlier.

Oats.—Should be sown freely this month; they are mostly left until the teams can be spared after putting in the wheat, and perhaps this is the better practice. Wherever practicable it would be better to sow earlier than is the usual custom, especially if good grain is required. The summer throughout this district is usually dry, and the early maturing varieties invariably give the best results. There is no better variety in this respect than Algerian.

Barleys.—Should be sown largely for grain and also for green fodder. They yield large quantities of grain, which is valuable for pig food and other purposes. The Skinless and Cape varieties are the best for green fodder; the Skinless withstands more dry weather than the Cape, and is earlier. Of the malting varieties, Kinver Chevalier, Carter's Malting, Invincible, and Standwell have proved the best; they require a good season with a favourable harvesting period to produce good malting qualities. They yield heavily, and the second grade grain makes excellent feed for pigs and other stock.

Ryes.—This crop thrives upon poorer soils than the other cereals, and is valuable for green fodder. For this purpose alone it should receive more attention than it usually does, especially with farmers whose holdings are upon the poorer soils. The variety known as Emerald Rye has done very well at this farm, producing large quantities of good quality fodder. The Arctic and Black Winter are also good varieties.

Lucerne.—This crop has not received the attention it merits. It is mostly grown upon the rich alluvial soils, where it yields very heavy crops. It also produces large quantities of fodder when grown upon the lighter soils, and it is questionable whether any other fodder plant will give a greater return for similar soils, throughout our dry summers, when they have been suitably prepared and put under this crop. It requires clean and thorough cultivation, and no crop responds better to such treatment. Many failures have resulted when such has been neglected. It can be sown early in the month, but it is preferable to sow during April, as the growth of the lucerne is small as compared to that of many weeds. Autumn sowing allows of it establishing itself before the heat of the following summer.

Canary Grass.—This crop should be grown this month, as it thrives throughout the district, and is at present a profitable crop. The demand is somewhat limited.

Onions.—Brown Globe, Brown Spanish (Yates' Select Long Keeping), and Market Model have proved good varieties, and seed should be sown in beds early in the month to allow of transplanting in well prepared clean ground. Land free from weeds should be chosen, and clean cultivation is necessary.

Vegetable Garden.—Sow largely of peas, the following varieties proving the best :—Yorkshire Hero, Stratagem, and Southern Queen. Also sow broad beans. Potato onion sets and tree onion bulbils and eschalots should be planted out. Small sowings of parsnips, carrots, cabbages (Succession), and Brussel's Sprouts should be made.

RIVERINA DISTRICT.—MAY.

G. M. McKEOWN.

Wheat.—The present month is one of the best for sowing in Riverina, and is the best in the neighbourhood of the Experimental Farm. Too much stress cannot be laid on the necessity for thorough preparation of the soil, as larger crops may be obtained from moderate areas well worked and treated with fertilisers, than from extensive areas which are simply "scratched," as is too often the case. It is to be feared that the experience of a few farmers who, in the splendid season just passed obtained good yields from paddocks simply scratched with a scarifier by way of preparation for sowing, may lead to a continuation of the practice in ordinary seasons. It should not be forgotten that the land had had a rest the previous year, that the rainfall was well distributed, and the conditions altogether exceptionally favourable for the production of good crops. If check areas had been sown in the best methods side by side with those sown in the slipshod manner above referred to, a fair test of the relative value of good and bad systems might have been obtained ; but as this was done in very few instances it is to be feared that farmers will use the worse methods, and as indications point to anything but a gcod season, many failures must result. The difference between good and bad systems was last year demonstrated in a very marked manner by experiments carried out under my direction on a large estate near Grenfell, where, in the same paddock, the farmer's crop was 17 bushels per acre, while seed drilled in without manure in our portion produced 31 bushels 42 lbs per acre. The blocks in which manure was drilled in with the seed yielded as high as 32 bushels per acre, this result having been obtained with 100 lb. of superphosphate, costing 4s. 8d. per acre. With 48 lb. of superphosphate, costing 2s. 4d. per acre, a yield of 29 bushels 24 lbs. was obtained. If every farmer would make simple tests of this kind for himself the value of the various methods would not long remain in doubt. In our own immediate neighbourhood, a farmer at a cost of £82 for fertilisers, secured an increase of crop worth £750. The farm tests again show that a moderate seeding will give the best results,

about half a bushel being a safe quantity for sowing up to end of May. If later sowing is unavoidable, the quantity may be increased to 40 or 50 lb., as late sown wheat does not stool as well as that sown early.

Barley.—In the free soils of the higher lands of the district profitable crops of malting barley may be raised, while in fair seasons good crops may be obtained on the lower lands with the aid of manure. The soil should be as deeply worked as is possible without bringing any of the subsoil to the surface, and should be brought into a fine condition by means of harrowing and rolling if necessary. Seed should be drilled at the rate of 25 to 30 lb. per acre, and with the seed should be sown superphosphate 50 lb. per acre. The best yields of grain have been obtained on the farm from Kinver and Golden Grain, Hallett's Chevalier being next in order. For green fodder, sow either Cape or the skinless variety, the latter being preferable, as it is beardless. For fodder, sow ¾ to 1 bushel per acre.

Green Fodder.—Should weather conditions admit sow field peas, vetches, oats, and rape.

Kitchen Garden.

Plant tree onions, potato onions, and eschalots, and sow onion seed on a limited scale only. Sow seed of cabbage and cauliflower, and transplant into well-prepared soil available plants of either kind. Among the best varieties of cabbage will be found Early Drumhead, Succession, and Improved St. John's Day; and cauliflowers, Early London and Asiatic. Sow broad beans and peas, of the latter the best being Yorkshire Hero, Stanley, and Daisy. Turnips, white and yellow varieties may still be sown.

AGRICULTURAL SOCIETIES' SHOWS.

1904.

Society.	Secretary.	Date.
Moree P. and A. Society	... S. L. Cohen	May 3, 4, 5
Dungog A. and H. Society	... Chas. E. Grant	4, 5
Coonamble P. and A. Association	... F. C. Lamotte	11, 12
Nyngan and District P. and A. Association ...	... R. E. Burns	18, 19
Walgett P. and A. Association	... Thos. Clarke	25, 26
Cobar P. and A. Association	... J. M. Scott	25, 26
New South Wales Sheepbreeders' Association	... A. H. Prince	June 29, 30; July 1, 2
Hay P. and A. Association	... G. S. Camden	July 21, 22
Riverina P. and A. Association..	... Wm. Elliott	26, 27
Condobolin P. and A. Association	... D. H. Tasker	27, 28
Narrandera P. and A. Association	... J. F. Williams	Aug. 3, 4
Forbes P., A., and H. Association	... N. A. Read	3, 4
Parkes P., A., and H. Association	... G. A. Seaborne	10, 11, 12
Corowa P., A., and H. Society	... E. L. Archer	16, 17
Murrumbidgee P. and A. Association	... A. F. D. White	24, 25
Gunnedah P., A., and H. Association	... J. H. King	24, 25, 26
Grenfell P. and A. Association	... Geo. Cousins	25, 26
Young P., A., and H. Society	... C. H. Ellerman	Sept. 6, 7
Junee P., A., and I. Association	... T. C. Humphrys	7, 8
Northern Agricultural Association	... C. Poppenhagen	7, 8, 9
Temora P., A., H., and I. Association ...	... W. H. Tubman	13, 14
Albury and Border P., A., and H. Society ...	... Walter Johnson	13, 14
Yass P. and A. Association	... Will Thomson	15, 16
Wyalong District P., A., H., and I. Association	... S. G. Isaacs	21, 22
Cowra P., A., and H. Association	... F. P. Faucett	21, 22

Orchard Notes.

W. J. ALLEN.

May.

The beginning of this month will see the greater part of the apple crop harvested, as also the commencement of harvesting of the main citrus crop. Those who are in a position to hold the latter will not be tempted to pull many unless the market is fairly good, preferring to hold for the later markets. At the time of writing American navels are selling at from 13s. to 14s. per case, containing from 150 to 250 fruits each. Our crop is light this year, and prices should rule fairly firm throughout the season.

This is a good month to plant all decidious refills, so that they will make a good strong start in the spring.

It would be well to bear in mind that our market is over-supplied with many varieties of inferior peaches and plums; it would, therefore, be well to give these fruits a wide berth for some time, particularly the plums. If good yellow-fleshed freestone peaches are planted, they would be suitable for any purpose—dessert, canning, jam-making, or drying—and in a certain degree the grower would be independent of the glutted fruit market, as if they would not bring a fair price on the market he could with advantage utilise them by drying them.

We have this year had erected at the Hawkesbury Agricultural College an evaporater which does good work, and from which we have turned out some good dried peaches, nectarines, and pears. The cost of the machine is about £110, and is of very simple design. We would be pleased to have all those interested in the work to pay it a visit of inspection. They could then see how it is built, and make any drawings of it they wish for their guidance if they have any thought of drying by this means in preference to the sun-drying process.

The fruit which is most neglected by growers is the apple. This is one of the easiest fruits to handle, as it exports well if grown in our cooler districts; and if best varieties are planted there is little doubt they will bring paying prices. Some of the best varieties for exporting are the Granny Smith, Stone Pippin (for cooking), and the Munroe's Favourite, Rome Beauty, Jonathan, Cleopatra, and any other firm and well-coloured keeping varieties suitable for dessert purposes.

The Cleopatra is very subject to bitter pit, and although a very heavy cropper most of the fruit is rendered valueless by this disease. This year, by repeated sprayings with Bordeaux mixture, we have managed to save from 70 to 80 per cent. of the fruit, but as our experiment has only covered this one year, I cannot say with any degree of accuracy whether we will always be as successful. We shall, however, continue the treatment.

The most suitable stocks for apple-trees are the Majetin for deep light soils, and the Northern Spy for medium light to heavy and shallow soils.

Mr. Thos. A. Kelly, a successful grower of Lyndhurst, sent me a photograph of some strawberries grown by him, and of which the length of five berries placed together lengthwise was almost a foot. He informed me that from a piece of land about 1 chain square he took 464 quarts of berries. He has from year to year selected his plants from those found to be producing fruit of the largest size. This has proved a wise precaution—in fact, it is always best to choose the best fruiting vines from which to take the young plant, as by this means you are improving the variety. The same remark applies to all other fruits.

Young strawberry plants may be set out this month in well-prepared soil, which has had a liberal dressing of manure.

The work of pruning the plum and peach trees may be commenced towards the end of the month.

At the recent Royal Agricultural Show a prize was given for the three best cases of cured lemons. Some excellent lemons were shown, nicely graded and packed, but they were not cured sufficiently. A cured lemon should have a somewhat tough, pliable, thin skin, and when the fruit is cut in halves it should be found full of juice—the latter being easy of extraction. A hard, firm lemon cannot be called a cured one, but if lemons are stored away for long keeping, it is best to keep them firm as long as possible, as by so doing they will keep the longer.

Crop Returns.

It is the intention of the Government Statistician to send out with the *Gazette* for next month forms for the collection of returns concerning the average yield and other particulars of the maize, potato, table grape, summer fruit, and wine crops of the season just closed.

The Government Statistician is much indebted to the numerous readers of the *Gazette* who sent him such carefully-prepared reports *re* the recent wheat estimate. On those returns, coupled with particulars supplied by the local police, Mr. Coghlan was able to form a correct forecast of the actual harvest. This was cabled to all the leading commercial papers, and it is on such reports that shipping has been chartered to come here to take the crop to the markets of the world. This shows the importance of the forecast being correct. As Mr. Coghlan is well aware, from the very accurate returns that have reached him from *Gazette* readers, that those who render assistance in this direction go to a considerable amount of trouble to collect the information, he has requested that this notice of his intention to ask for returns concerning other crops may be given in time to enable recipients of the *Gazette* who are kind enough to co-operate to have a good look around before the forms come to hand.

Notes on Cereal Crops at Wagga Farm.

SEASON, 1903.

IN districts such as the Wagga Farm is representative, the amount of rain which falls during the critical stages of growth is the dominating factor in cereal production. Thus the rainfall of 1903 which occurred as follows :—

January	45 points.	July	213 points.
February	20 ,,	August	51 ,,
March	227 ,,	September	311 ,,
April	505 ,,	October	158 ,,
May	84 ,,	November	87 ,,
June	180 ,,	December	60 ,,

totalling 19·41 inches for the twelve months, although below the average of 22 inches, which, however, since 1896, has only been reached once, was good for wheat grain crops, inasmuch as the principal precipitation was at sowing time and the period of flowering.

For barley, however, the October and November falls were rather too light to produce the best results. Mr. McKeown is of opinion that during September and October a minimum fall of about 4 inches is necessary for the full development of a wheat crop, provided the rain at sowing time and during the growing period has been fair.

It is found at Wagga that September and October are the most critical months in the existence of a barley crop in Riverina district. When sufficient rain falls at that stage the barley grown in the Wagga soils is of a very high quality and the yield is heavy; but if the necessary moisture is not forthcoming the grain will not fill, and the grower suffers the loss, not only of diminished yield but in the difficulties of disposing of a sample unacceptable to malsters. It is on this account that Mr. McKeown feels the necessity of advising farmers, in districts where the rainfall at critical periods is uncertain, to think well before they launch out extensively in the production of barley for malting. Where the grain can be disposed of remuneratively for feed, or where it can be utilised as a fodder on the farm, barley is, of course, always well worthy of consideration.

The following are the results of the season's work. It is unfortunate for the sake of those who look to this kind of work for guidance, that the results were not available in time for last issue, but the fact is that in determining the results of so many different experiments it is impossible to get out the returns earlier. For instance, it will be noticed in Paddock No. 1 that no less than seven different plots were sown, with varying quantities of manure. All these plots must be harvested separately and threshed separately, and for the sake of the absolute accuracy that is essential, the machines must be carefully cleaned after each variety has been handled. All these minutiæ take

time which is not decreased by the adoption of a system under which the students at the Farm are afforded opportunities of acquiring practical experience not only in connection with the production of the crops but also in the harvesting and threshing of them.

Wheat.

Trials of Manures.—Field crops sown under conditions appertaining to ordinary farms.

No. 1 Paddock.—Variety of wheat, Farmer's Friend; sown early in June.

		Per acre. bush.	lb.
*No manure		16	49
25 lb. per acre bone phosphate, cost 1s. 2d.		15	12
Land lower suffered from overflow of water, causing weed growth, and checking crop.			
35 lb. per acre bone phosphate	cost 1s. 9d.	21	25
60 lb. ,, ,, ,,	,, 2s. 9d.	23	15
60 lb. ,, superphosphate	,, 2s. 9d.	28	29
60 lb. ,, Japanese superphosphate,	,, 2s. 9d.	24	12
60 lb. ,, superphosphate, with small per cent. nitrogen	,, 3s. 9d.	24	3

No. 2 Paddock.—Variety of wheat, Farmers' Friend.

		bush.	lb.
60 lb. bone phosphate, per acre	cost 2s. 9d.	26	36
*No manure		13	15

* This block has been cropped without manure since 1896, when it received a dressing of superphosphate; but the block in No. 1, not manured, has been manured once since 1896, when it was sown with rape, and manured at rate of 80 lb. per acre superphosphate.

No. 2. Paddock—Variety of wheat, Bobs.

		bush.	lb.
60 lb. super., per acre	cost 2s. 9d.	29	7
60 lb. Japanese super., per acre	,, 2s. 9d.	29	23
Following bone phosphate sown and cropped previous year, Hudson's Purple Straw variety.			
60 lb. superphosphate, per acre		34	6
Same variety of wheat and quantity of manure following superphosphate		32	5

VARIETIES OF WHEAT all manured with 60 lb. superphosphate per acre, costing 2s. 9d.

	Bush.	lb.			Bush.	lb.	
Federation	38	11	per acre.	Zealand	24	17	per acre
Steinlee	35	27	,,	Schneider	32	13	,,
Steinwedel	34	30	,,	Sussex	25	18	,,
Hudson's Early	34	6	,,	Lambrigg White Lammas	23	27	,,
Nonpareil	33	44	,,	Australian Talavera	28	45	,,
White Essex	32	16	,,	Algerian	24	38	,,
Jade	30	52	,,	Plover	31	21	,,
White Tuscan	29	10	,,	John Brown	32	27	,,
Farmer's Friend	28	29	,,	Cumberland	28	30	,,
Tardent's Blue	27	38	,,	Field Marshal	28	14	,,
Dart's Imperial	24	35	,,	Jonathan	26	57	,,
Bobs	29	7	,,	Poland	14	21	,,
Field Marshal	28	14	,,				

Mr. McKeown also carried out experiments with manures at Iandra station, near Grenfell, with the following results:—

SEED and manure sown together with drill in 5-acre blocks full length of paddock.

Sown, May 22 to 28.	per acre. lb.		bush.	lb.
No manure	......	....	21	42
Superphosphate	48	cost, 2s. 4d.	29	24
,,	80	,, 3s. 10d.	30	26
,,	100	,, 4s. 8d.	32	1
,,	150	,, 7s. 0d.	30	38
Bone phosphate	96	,, 5s. 1d.	25	40
Superphosphate	84	,, 5s. 8d.	29	38
Sulphate ammonia	14			

Sown, May 22 to 28.	per acre. lb.				bush.	lb.
Superphosphate	84					
Nitrate of soda	28	,,	6s.	11d.	30	11
Bonedust	112	,,	6s.	5d.	22	40
Superphosphate	84					
Sulphate ammonia	14	,,	8s.	0d.	29	14
Nitrate potash	14					
Superphosphate	56					
Sulphate ammonia	28	,,	8s.	2d.	29	0
Sulphate of potash	14					

The rest of the paddock was sown by the tenant farmer in the ordinary way, viz., broadcast and without manure; and it returned 17 bushels per acre.

Comparison of Drilled and Broadcast Crops at Wagga.

Drilled, 23 bush. 15 lb.; broadcast, 21 bush. 26 lb.

Quantities of Seed (drilled).

	Bush.	lb.
20 lb. per acre	24	14
40 lb. ,,	24	38
60 lb. ,,	23	15

Concerning late and early sowing Mr. McKeown says:—"As a general practice I recommend half a bushel if sown before the first week in June; then it should be increased to 45 to 60 lb. according to variety of wheat. However, the experience at Wagga Farm is that it pays better to let the land lie fallow rather than sow late, because as a rule only half the possible crop is harvested. Occasionally, however, a success may be scored with a late sown crop, but it seldom happens."

Malting Barley.

	bush.	lb.	
Kinver	34	14	per acre.
Golden Grain	32	46	,,
Hallett's Chevalier	32	27	,,

All of splendid colour, the first, an earlier kind, a full plump grain, but the two last were somewhat thin owing to rainfall in October and November being insufficient for filling.

Some new kinds from America tried in small areas yielded up to 40½ bushels.

The most valuable of the new kinds appears to be the Silver, a skinless fodder variety, which yielded 31 bushels per acre of excellent grain, against 13½ obtained from the old skinless kind.

Oats.

Oats are only grown in small areas; the best yield being obtained from Salzer's Great Northern 73 bus. 28 lb. per acre, followed by White Tartarian with 55 and Salzer's 20th Century with 47½ bushels.

The season was a very favourable one for oats which require good autumn rains to carry them through.

Practical Vegetable and Flower Growing.

W. S. CAMPBELL.

Directions for the Month of May.

Vegetables.

As rain has fallen over a considerable portion of the State during the early part of the month of April, vegetables of several varieties should be abundant wherever some little care has been taken to sow and plant in such a manner as to keep up a succession. Probably during May frosts will visit us, but so far (writing in the middle of April) the weather has been more like summer than autumn, although deciduous plants are casting their leaves. In the warm coastal, almost tropical, parts of New South Wales tender vegetables may still be sown or planted, and French beans, tomatoes, potatoes, capsicums, and others may be grown through the year. However, where the country has been denuded of timber, and there is no protection against cold winds, frosts appear now where some years ago there were no signs of them. The almost insane desire on the part of settlers to destroy all shelter timber on their farms as quickly as possible is likely to cause no end of mischief before many years are over, and there will be a howl for shelter trees to replant these depleted areas.

Asparagus.—It would be as well to prepare some ground whenever convenient, if only for a few plants. A dozen or so well-grown and cared-for asparagus plants should provide a considerable amount of shoots, perhaps quite sufficient for the family. If the soil is not naturally of good quality, mix an abundance of manure with it when trenching. Sheep, horse, cattle, or fowl dung, either alone or better still mixed together, and if possible well rotted. This is the stuff to make good vegetables, and as there should be abundance available on every farm, it needs only the little trouble of collecting and storing to keep a supply handy. The planting may await until early in the spring.

Beans, Broad.—If seeds were sown last month the young plants should be growing satisfactorily. They should be well cultivated and weeds destroyed. The growth of weeds has been considerable, and it requires a little perseverance to clear away. Sow two or three times during the month, if it is considered that the sowings of last month are not likely to suffice.

Beans, French or Kidney.—Sow only to a limited extent in the warm districts of the State.

Beet, red and silver.—Keep any young plants which are making headway, from sowings last month, well cultivated and free from weeds, and attend to thinning out. No further sowings need be made at present.

Borecole, or Kale.—Sow a little seed if any more plants are needed.

Brussels Sprouts.—Deserves to be grown largely, especially in cool climate districts. Sow a little seed in a seed-bed. Any seedlings on hand large enough to shift should be pricked out with a view to planting them out when they have grown sufficiently large.

Cabbage.—Sow a little seed two or three times during the month, according to probable requirements—the object to be kept in mind being the desirability of having on hand just a little more than enough plants to keep going, that is, allowing for probable losses. There is no need to make one huge sowing and then waste most of the plants, as is frequently done. A little practice will soon enable anyone to judge how much seed to sow at any one time, and how many times to sow during the month.

Endeavour to make the young cabbages grow well at the start by good supplies of manure, and by frequent cultivation, but not by earthing them up. They will then be better able to withstand the attacks of aphis, and perhaps other pests.

Cauliflower.—Grow and treat like the cabbage, and never let the plants have a check from the time they appear above the soil until they are cut for table.

Carrot.—As this is a good time for the growth of the carrot, sow as largely as you consider desirable, and as frequently, but at the same time not to overdo it, and neglect other and perhaps better kinds of vegetables.

Celery.—A few plants may be planted, if any are available.

Endive.—Sow a little seed, and plant out any seedlings that are available. This is a useful winter salad plant, rather more bitter in taste than lettuce, but preferred for that reason by some persons. Use plenty of good rotten manure for this vegetable.

Leek.—Sow seed largely two or three times during the month, if a good supply is required. It is a favourable time for sowing during the month. When planting out use abundance of good manure for the young leeks, and occasionally give them some rather strong liquid manure if you desire to grow the plants to perfection.

Lettuce.—Sow seed largely during the month, and plant sufficient seedlings when they are strong enough to keep up a good supply.

Onion.—This is worth taking a good deal of trouble with, for a supply of good onions is almost a necessity in every household, and as the onion succeeds almost everywhere in New South Wales, it will be nothing less than disgraceful for anyone who can grow vegetables not to keep himself sufficiently supplied with onions. If the soil is not naturally rich enough use abundance of manure; dig it well into the soil. See that the ground is well drained, and make the surface as fine as you can for the seeds. Sow not more but preferably rather less than half an inch deep, and sow in drills, unless pickling onions are required, when the seed may be sown broadcast. For keeping purposes, try Brown Spanish or Anderson's Market Model. The soft onions soon decay if at all bruised.

Parsley.—Sow a little seed.

Parsnip.—Sow a little seed now and then during the month.

Peas.—Keep a supply of peas going by sowing several times during the month. As soon as the plants are well above ground, hoe the surface, and do so frequently. Be sure to "stick" them before they grow too large.

Radish.—A little seed should be sown occasionally; just sufficient to keep up a sufficient supply of plants. Use plenty of well-rotted manure, and endeavour to induce the radishes to grow as quickly as possible, and use them when they are quite young and tender.

Mustard and Cress.—Sow a little seed from time to time.

Water Cress.—Cuttings or rooted plants may be put in at any time, and if kept well watered they should succeed well enough. It is not absolutely necessary that this plant be grown in water.

Seakale.—Sow a little seed.

Spinach.—Sow a little seed.

Shallots.—Plant out a few cloves in rows 12 or 15 inches apart.

Herbs.—Sow a little seed. Lift, divide, and replant old clumps which have become overgrown.

Flowers.

THIS month is generally one of the most pleasant of the twelve. Numerous plants should be in full bloom, and the flowers are prettier, of better colour, and of more lasting qualities than those of the spring. Many dahlias are still flowering, also chrysanthemums, roses, bouvardias, zinneas, and also the beautiful camellias, which should now be out in perfection.

It is not too late, in the warm districts, to plant out all kinds of evergreens suitable for gardens, and amongst them are the camellias and bouvardias, which should not be forgotten.

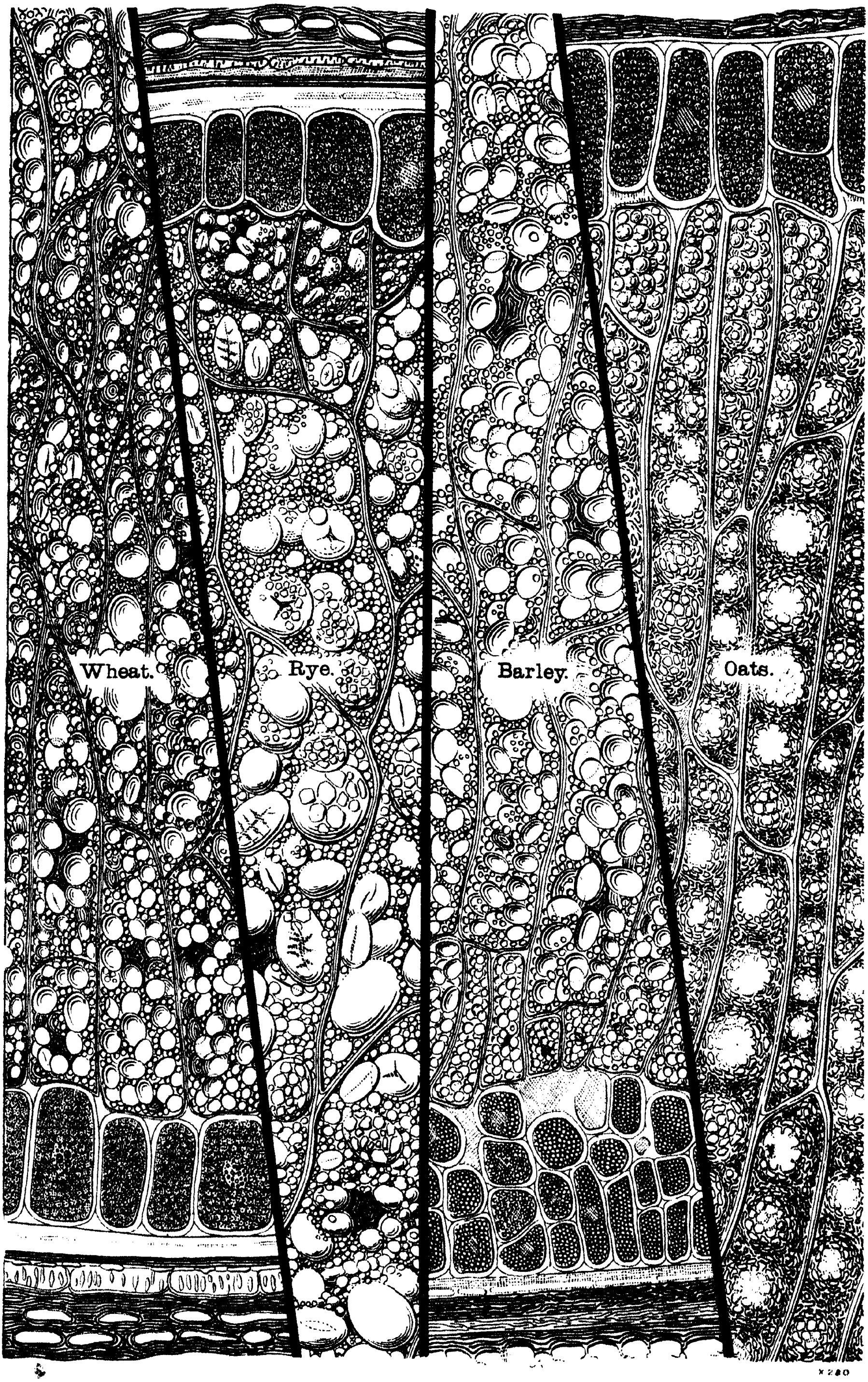
Hardy annuals may be planted out freely, and if seedlings have not already been raised, seed may be sown under protection, but the sooner this is done the better.

Bulbs of spring flowering varieties may still be planted if they can be obtained. Some of those planted last month should be showing above ground. Unless the places where the bulbs are are marked, great care will have to be taken when cleaning up the garden and weeding not to injure or disturb any of the bulbs which are still below the surface.

Salvia pseudococcinea, JACQ.

A PRETTY West Indian plant, an escapee from gardens, does not appear to have been hitherto recorded as a New South Wales weed. It is a pest on the edges of brush lands in the Big Scrub, Richmond River. I have also noticed it from Coff's Harbour to Grafton. It is a bad weed in Norfolk Island.—J. H. MAIDEN.

[5 plates.]



Comparative cross-sections, reaching to near the centre of four cereal grains. The greater portion of each section is occupied by flour-cells, containing starch grains (shown) and protoplasmic matter (mostly not shown). The darker finely-granular cells constitute the aleuron layer (compound in Barley). The flour-cells, and their included starch granules, average smaller the nearer they are to the outside of the grain. The starch granules of oats are compound.

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Agricultural Gazette of New South Wales.

Universal Nomenclature for Wheat.

(Continued from p. 363.)

BY N. A. COBB.

Structure of the Flour-cell as disclosed by the aid of the foregoing Tests.

The ordinary distribution of the gluten in a flour-cell is well shown in the illustration on the following page, drawn from a small flour-cell prepared in the manner described. Larger flour cells than that illustrated are more complex, but otherwise present no feature not shown on a smaller scale in the illustration. The removal of the starch granules leaves the protoplasmic matter as a network, which, according as it increases in amount, tends to assume the character of a matrix or mould, in which, for instance, the starch granules might be imagined to have been cast. These latter features are the more pronounced the greater the percentage of gluten, and, in general, the nearer the flour-cell is to the outside of the grain.

In this network, and for technical purposes constituting a part of it, so far as the manufacture of flour is concerned, is the nucleus of the flour-cell. This takes the form natural to the pressure on it of a number of starch granules, and hence usually presents a contour showing a number of arms, almost justifying the application in some instances of the term stellate. Using the biological terms, and speaking of the main part of the network as the cytoplasm and of the nuclear part as the karyoplasm, we may say that the cytoplasm displays a very finely granular structure, to be seen only with very high powers, while the karyoplasm is more coarsely granular. The distribution of the chromatin in the karyoplasm of "ripe" flour-cells is not sufficiently definite in any cells examined by me to furnish evidence as to the number of the chromosomes (said to be sixteen in *Triticum*); and this notwithstanding the fact that one occasionally comes across cells with two distinct masses of karyoplasm, and hence apparently in mitosis.

The nucleus, though usually approximately central, is not infrequently found in an excentric position, in some cases being marginal.

The wall of the flour-cell is exceedingly thin, thinner than in most of the related cereals, and the manipulations described usually destroy it, so that the protoplasmic network is left naked. However, cells may be found now and then in which the cell-wall remains unbroken; such cells give a somewhat better idea of the general distribution of the net-work, but as a rule are lacking in detail. These net-works within unbroken walls may be prepared by simply heating in water some well macerated cells.

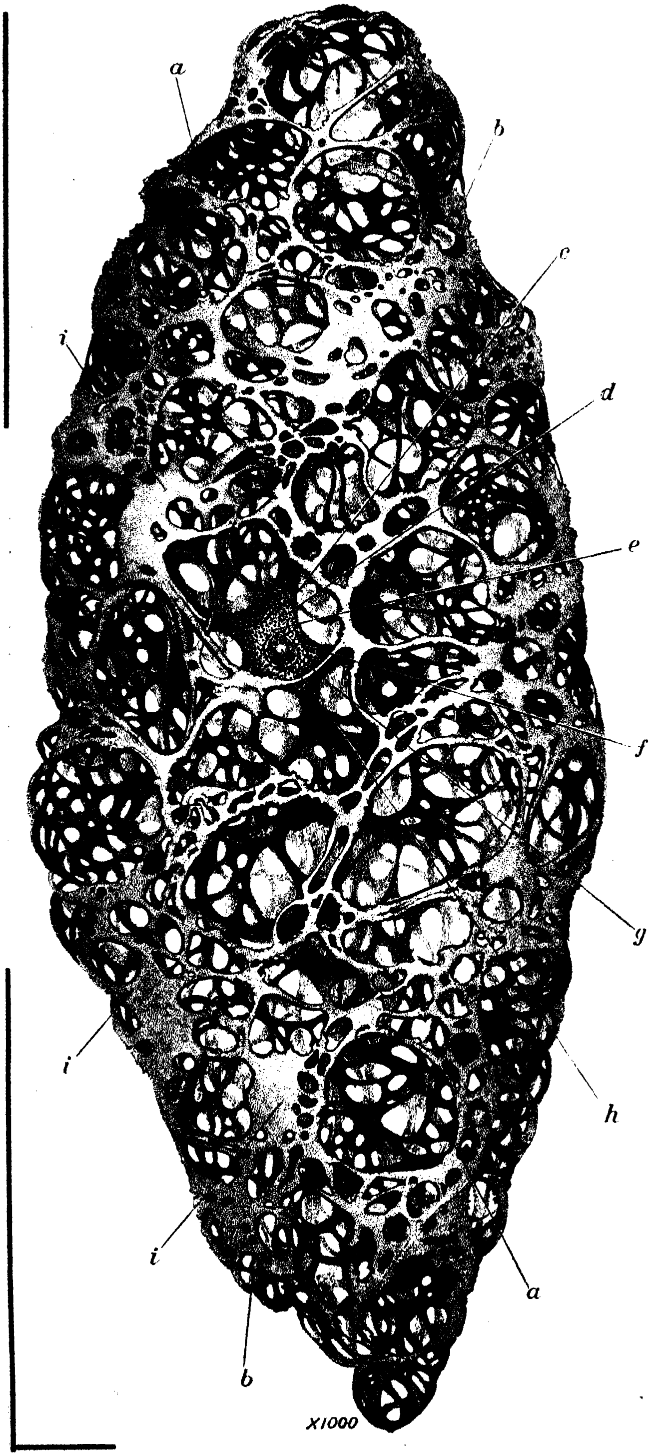


Fig. 74.—A small flour-cell taken from a grain of typical Australian wheat, magnified to one thousand diameters. The wall of the cell has been removed during the manipulations. The starch has been removed by the simple processes described in the text, so that the protoplasmic network and nucleus, constituting the gluten, are displayed in detail. *a*, *b*, the network in whose alveoles large and small starch granules were held enmeshed; *c*, the wall of the stellate nucleus, which, owing to the action of analin water safranin, has been stained to a rather dark red; *d*, the nuclear reticulum, or chromatin of the nucleus; *e*, more or less colourless zone surrounding the true nucleolus; *f*, wall of the nucleolus; *g*, granular components of the nucleolus; *h*, vacuole of the nucleolus. The stellate form of the nucleus is due to the pressure of the starch, which forces some of the nucleus into the crevices among the adjacent starch granules. *On being dissected out*, the nucleus is seen to be granular and to possess a vacuole. This latter may sometimes be seen in ordinary preparations. The granulation of the nucleolus, however, is hidden by that of the chromatic matter of the nucleus, and hence ordinarily would escape observation. The known difference in chemical composition between the cytoplasm and the karyoplasm makes the relative amounts of these constituents in the flour-cell worthy of special notice. There is a definite chemical contrast between the cytoplasm and nucleus.

Between the flour-cells, as between the aleuron cells, a distinct cement substance may be demonstrated with the aid of colour reactions. Analine water safranin colours this substance pink.

The cell illustrated in Fig. 74 came from toward the outside of the grain, where the network assumes more the character of a matrix, as previously explained. In the majority of the cells of this variety of wheat the network would be of a looser character, with larger alveoles and smaller threads. A small cell was chosen for the illustration as allowing the high magnification necessary to figure the network in detail. The larger cells would be more elaborate, the nucleus presenting the same features.

An examination of the half grown grain shows the network of protoplasm to be of about the same general appearance and conformation as in the ripe grain, though there is no appearance of the finer detail shown in Fig. . In the unripe grain the flour cells cannot be isolated by maceration as in the ripe grain, and if it is desired to isolate them this must be done by dissection, an operation that presents few difficulties to a skilled microscopist. In the unripe cells the starch not having yet appeared in its full amount, its grains do not press on the nucleus, so that the latter has the usual nearly spherical form. After the removal of the starch by the aid of heat as in the case of the ripe cell, one may observe the detail of the nucleus to better advantage than in the ripe cell.

Examination of Gluten in various non-aqueous fluids from well-grown but unripe Grains.

1. *In the Sap of the Green Grain.*—This operation may be accomplished with no very great difficulty. The main trouble is the lack of sufficient fluid to wash away the starch. Thus the gluten cannot be cleaned. It can, however, easily be accumulated, so as to unmistakably demonstrate its presence. If the green grain be rolled for a few minutes between the finger and thumb with just sufficient pressure to avoid rupturing the skin, the gluten is accumulated to some extent in the grain. But with this process it is not possible to clean the gluten. It may be accumulated and placed by itself, and if water be then added, it may be proved that the accumulated matter is really pretty pure gluten.

2. *In Kerosene.*—The accumulation of the gluten in this fluid resembles that in water. There is a tendency to form emulsion, but this tendency is less than in olive oil, and in no way obscures the result.

3. *In Olive Oil.*—The accumulation is difficult owing to the formation of an emulsion. If the gluten be drawn out on to dry glass, and be moved along on the glass at the same time that it is attempted to accumulate or mould it together, it may be gradually brought to a gluten-like consistency, but the result is not satisfactory.

4. *In Turpentine.*—This fluid has the effect of turning some other part of the contents of the unripe grain into a condition resembling gluten, so that the "reaction" is masked, but the accumulation appears to be mainly gluten.

5. *In Saliva fresh from the mouth.*—The accumulation in this fluid seems to be rendered impossible by a digestive action of the saliva, or, possibly, by the viscid nature of the fluid.

6. *In Absolute Alcohol.*—Unsuccessful, as the alcohol immediately extracts all the water from the tissues, and appears to coagulate the protoplasm.

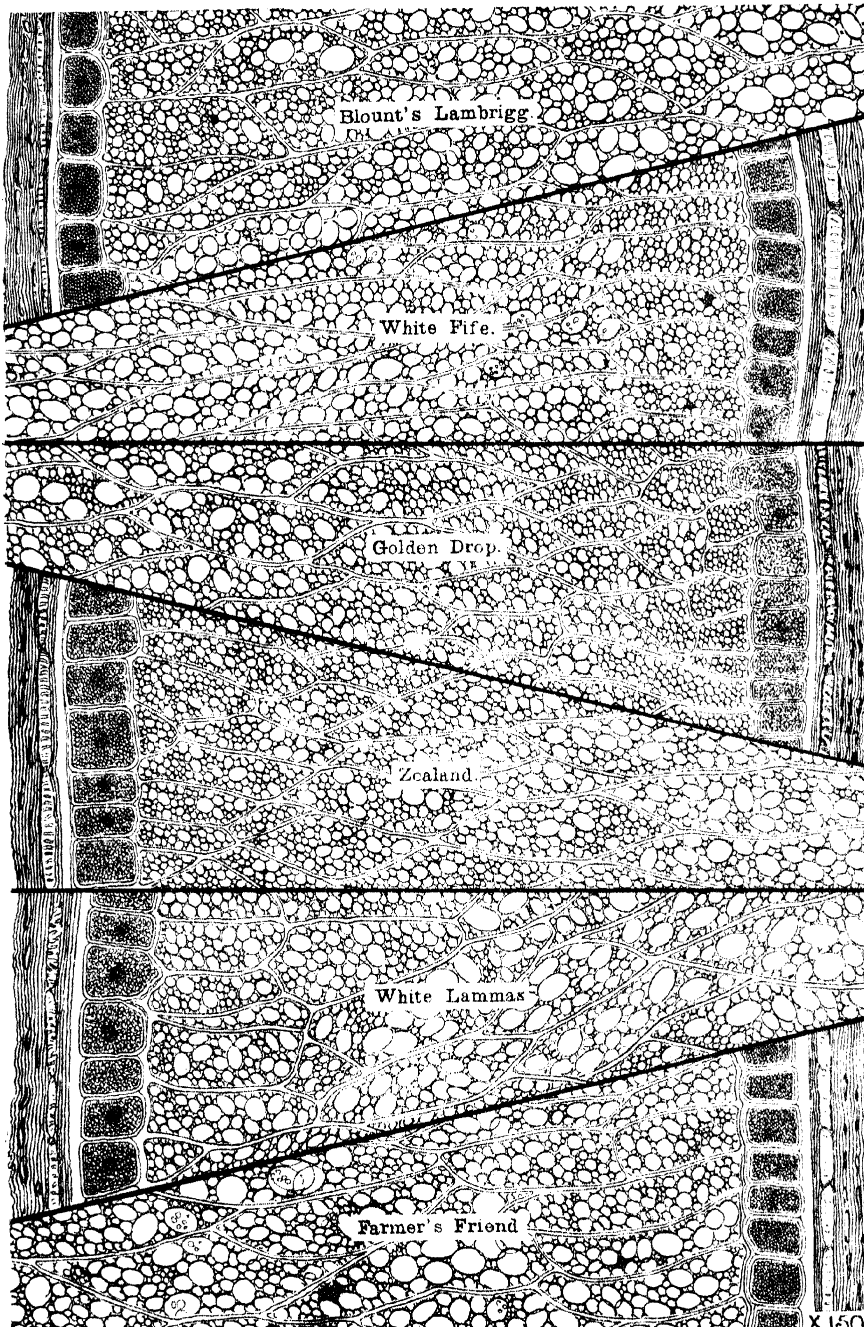
7. *In Chloroform.*—Not successful, though there appears a substance of somewhat the consistency of gluten.

8. *In Glycerine.*—The clearing action of this fluid comes into play, and the gluten collects as a transparent substance instead of a milky one.

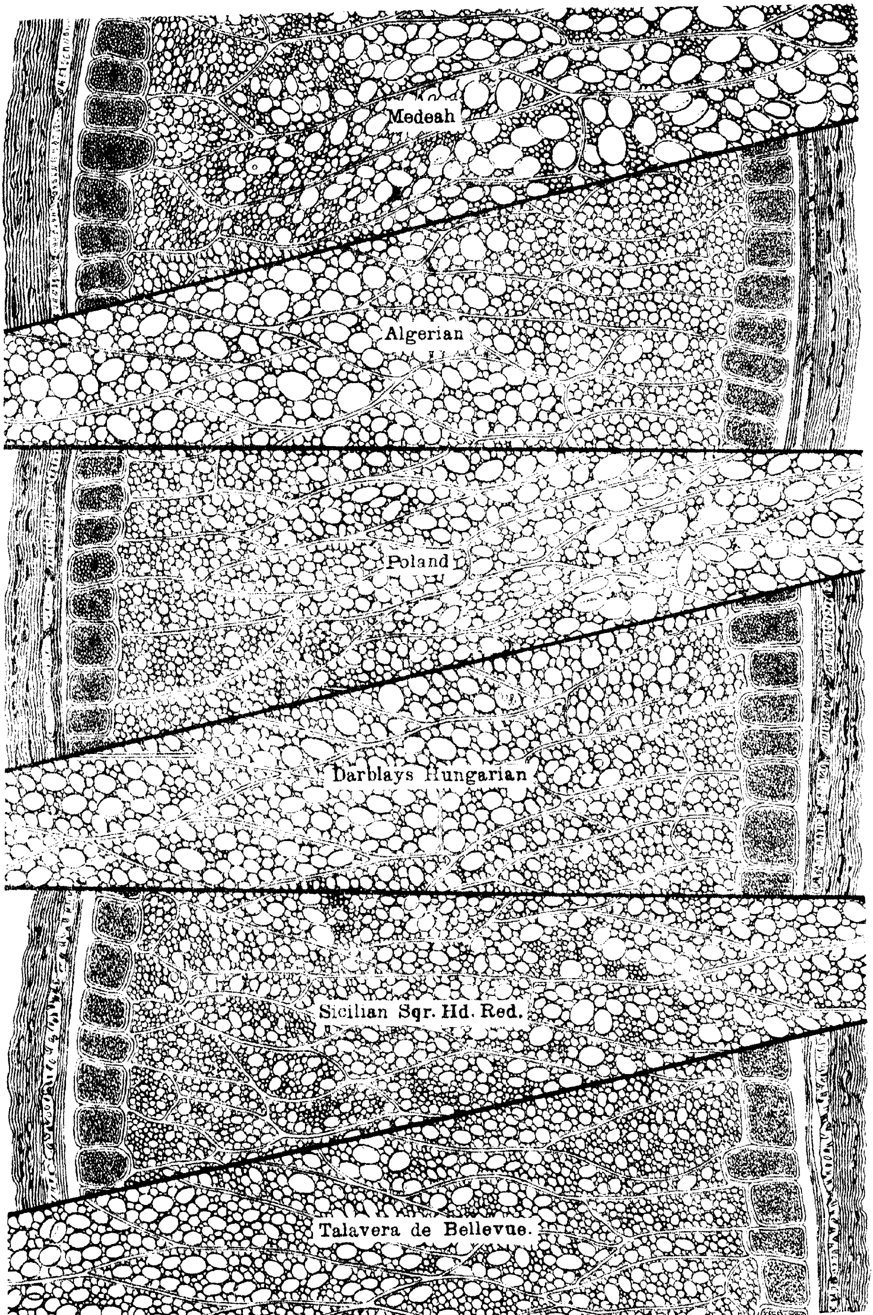
A comparison of the various flour-cells in a given grain shows a number of interesting points. In the first place, it can hardly fail to strike the observer that the outer flour-cells are smaller, and that they contain smaller starch granules. This feature is common to all varieties of wheat, and is in accord with the increasing amount of gluten found in the flour derived from those portions of the grain nearer the outside. It is noticeable that when the grain is rich in nitrogenous matter the number of large starch granules is smaller. As we pass, in such grains in our examination from the centre to the outside, we note a gradual decrease in the size of the starch granules, and even at some little distance from the aleuron layer the cells are filled with small granules only. It will be noted in the four illustrations on Plate XIV that this distribution of the large and small starch granules is similar in other cereals, and that we have here to do with a natural law governing the distribution of starch in such seeds. It may also be noted in the same figures, that whenever the starch grains are large the cells containing them are also large, and a little reflection on the subject will, I think, convince the reader that there is some reason to believe the quality of the flour derivable from the grain of a cereal is connected in some way with this feature of its structure, and may be judged or predicted from such evidence. Compare the well known qualities of the various flours with the sections taken from wheat, barley, rye, and oats, as illustrated in Plate XIV.

If now, after this comparison, we return to our subject, the comparative study of the endosperm of the wheat grain, we find ourselves more fully inclined to believe that the quality of the flour derivable from the grain is predictable from a knowledge of the histology of the grain. Plates XV and XVI contain drawings of the endosperm of a number of wheats taken out for comparative examination. Each section is taken from the middle of a grain of average size, selected from among sections taken from grains representing the growth of three different years. From this it will be seen that the sections are probably worthy of fairly strict comparison. If we take the names of the wheats as an index of their qualities, we arrive at the conclusion that richness in nitrogenous matter goes with small cells filled with small starch granules.

It is very interesting and, for the purposes of the plant breeder, important to note the fact that the distribution of the small flour-cells containing small starch grains, and therefore rich in gluten, is not



Comparative drawings from transverse sections from near the middle of the back of various Australian-grown wheat grains, to show the form and distribution of the flour-cells and their contents. Each section was an average selected from the crops of three successive years. Rather strict comparisons may therefore be made. Varieties noted for the large percentage of starchy matter in their flour have comparatively large flour-cells and starch granules, even near the outside of the grain, as is shown, for instance, in the cases of Farmer's Friend and White Lammas. Durum wheats have large-sized starch-granules.



The sections are of such a size that they reach to near the centre of the grain. The wider end of each section represents the outside of the grain. The dark squarish cells are the aleuron cells, a single layer of which constitute the aleuron layer. It will be noted that these cells vary to some extent in the various varieties when seen in this manner, as they did also when viewed in a radial direction, as shown on the earlier plates. It will be noted that the bran is half as thick again on some varieties as it is on others.

completely enunciated by saying that such cells are more numerous according as we approach the periphery of the endosperm, for although this is true in a general way, it is not equally true in all parts of the grain. If, for instance, we observe the cells near the aleuron layer, we shall see that in that part of the grain near the crease, but more particularly near the tip of the grain, the starch granules are comparatively large even near the very outermost part of the endosperm. If this is regularly the case it may throw doubt on the advisability of deepening the crease by selection, as has been done, I believe, in the past. The argument has been that as the gluten resides more particularly near the surface of the grain it is advisable to increase this surface with the hope of increasing the nitrogenous contents of the flour. I am inclined to doubt whether this idea has had sufficient basis in fact to warrant all that has been done in its name. I think from what I have seen that it might be well to undertake a series of selections based on the distribution of the starch and gluten in the endosperm, as determined by the biological analysis and the microscopic appearance of the cross-section, with the idea of testing the truth of the supposition that an increase in the depth of the crease is advisable. I do not need to call attention to the fact that any additional depth in the crease adds to the amount and weight of the bran.

As has been shown by various investigators, the grain of wheat is penetrated at its base by a single vascular bundle, and this bundle extends along the crease to near the tip of the grain. We may reason that most of the nourishment of the grain is supplied to it through this channel. I have called attention to the existence of a number of stomata near the crease, and just at the base of the brush found on the tip of the grain. As these stomata are well developed it is necessary to assume that they function actively during the growth of the grain. If we add to the nourishment taken in through the above-mentioned vascular bundle that taken in through these stomata, we exhaust the list of food supplies to the grain so far as known. We must, beyond doubt, it seems to me, assume that by far the greater part of the nourishment arrives by way of the vascular bundle. It is, therefore, important to inquire in what manner this food is distributed from the bundle to the endosperm, if we wish to understand the physiology of the grain sufficiently well to make it the basis of improvement by selection. We find the vascular bundle located outside the aleuron layer, and as this latter is spread over practically the whole surface of the endosperm, it appears that the food distributed from the vascular bundle to the endosperm must pass through the aleuron layer. From this we see what an important part the aleuron layer plays not only in the germination of the seed—something that has been already well recognised—but throughout the growth of the seed, a fact, I think, not so well recognised. In accordance with this importance of function of the aleuron layer as a transmitting agency is the richness of the protoplasmic connection between the aleuron cells and the subjacent cells of the endosperm.

(*To be continued.*)

Some Fern and Orchid Pests.

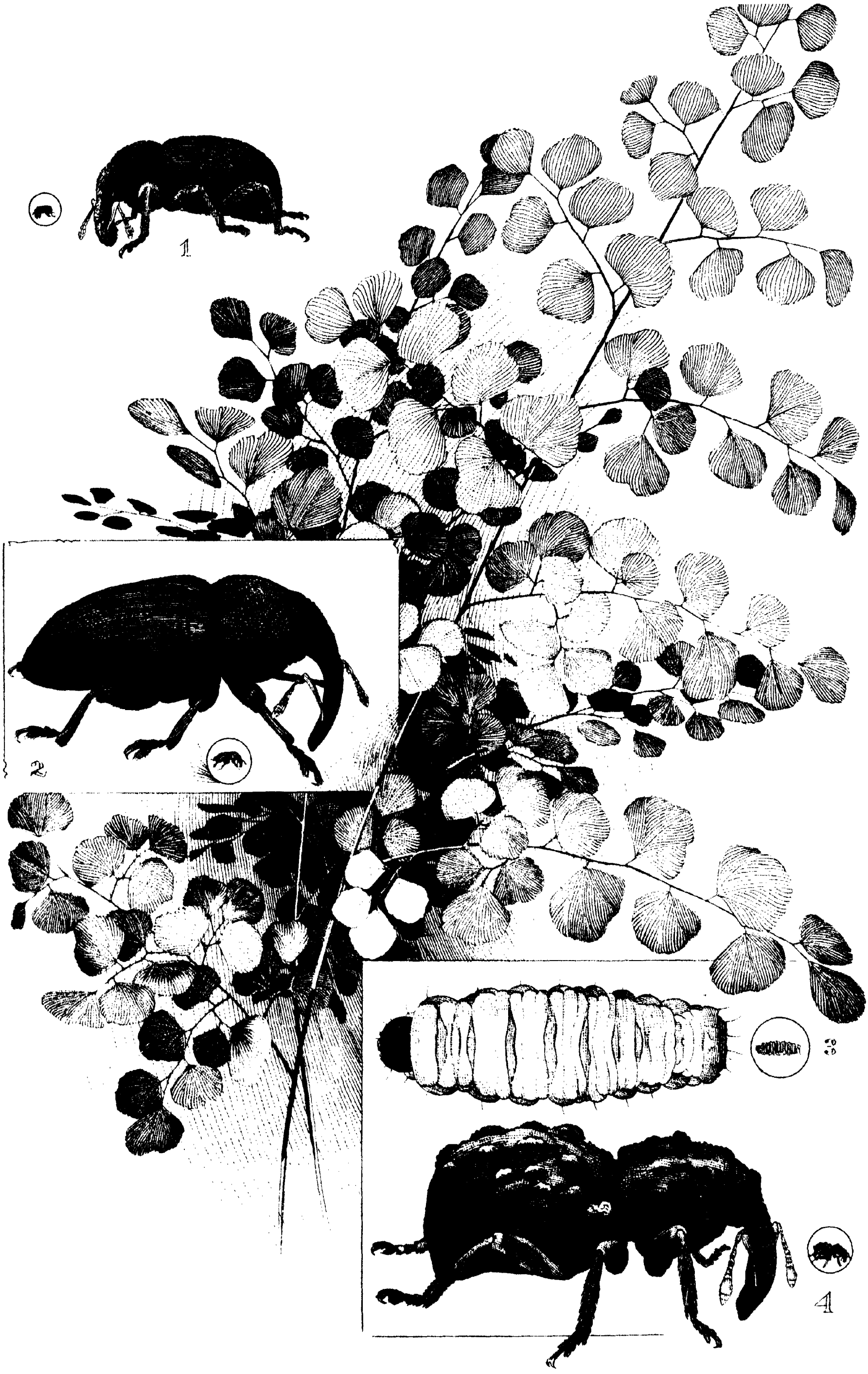
WALTER W. FROGGATT, F.L.S.,
Government Entomologist.

PLANTS grown under the shelter of bush-houses, or the more or less unnatural conditions of the hot-house, are always, in spite of care, more subject to the attacks of insect pests than their more robust cousins growing in the open. Red spider, thrips, aphis, snow-fly, and many scale insects flourish in the warm air, and the plants have to be constantly watched and cleaned to keep them in a healthy condition. There is also another danger to the hot-house plants, and that is the introduction of foreign or outside pests with the new plants that are being constantly imported from abroad, and the only way to minimise this danger is the careful examination of every plant, and a strict quarantine for some weeks before it is placed among the clean plants.

In these few notes I propose to give some account of several beetles that have been accidentally introduced into ferneries and bush-houses, and two of which are a very great pest to fern-growers.

The Maiden-hair Fern Weevil. (Neosyagrius cordipennis, *Lea.*)

This little beetle has been known for some years as a destroyer of these delicate ferns, and when once it obtains a footing in a fernery it is very difficult to dislodge. The beetle living concealed in the earth at the base of the fronds during the day, emerges only at night, crawling up the stalks to both feed upon the foliage and insert her eggs in the stems; so that it is not until the frond begins to droop and wither through the presence of the small larvæ that the damage is noticeable. The larva soon hatches out of the egg, and after feeding down the centre of the stalk pupates in the end of its burrow, changing into a white semi-transparent chysalid. The fully-developed grub is slender, pale yellow in colour, with the head reddish-brown; it measures 1½ lines in length, tapers somewhat to the tip of the abdomen, which is truncate when viewed from above, and the whole lightly clothed with scattered short hairs. The thoracic and abdominal segments are finely corrugated or ridged; unlike most weevil larvæ they do not curve themselves round, and can extend themselves nearly twice the length when moving. Sometimes the larvæ feeds up the stem, but its general way is downwards, so that cutting off all damaged fronds close to the soil and burning them will destroy the grubs. The beetle is a tiny black weevil, with a short heart-shaped body (from which Lea has given it the appropriate specific name of *cordipennis*) with a much roughened integument, covered with curious little brown scales.



SOME BUSH-HOUSE AND FERNERY PESTS.

1. A Fern Weevil (Neosyagrius cordipennis

2. Orchid Weevil (Baris orchivora).

3 and 4. Larva and adult Fern Weevil (Syagrius fulvitarsis).

Remedies.—A number of experiments have been carried out as to the best method of ridding the ferns of these destructive beetles, and though at first many fern-growers, considering the first loss the best, destroyed all the infested plants, it is now found that by placing the ferns, pot and all, under water in a tub, that the beetles are soon driven out, and come struggling to the surface. I have found that within half an hour beetles will be found floating on the surface of the water, but I am told that ferns placed overnight in lukewarm water will be quite clean after they are removed, and flourish better than ever. The warm water not only brings all the beetles out of the soil, but penetrates into the damaged fronds and smothers the larvæ and pupæ. It would be advisable to see that the sides of the tubs or tins in which the plants are submerged are perfectly clean, so that the beetles could not crawl out and escape, and all beetles on the surface of the water should be collected and dropped into the fire or a tin of boiling water or kerosene, as they have wonderful powers of recovering from submersion. If the fernery is visited at night, and the infested plants carefully examined and shaken over a sheet of paper, many beetles can be caught and killed; but they are very sensitive to light, and a sudden flash of light or movement of the visitor will cause them to drop at once before they can be captured. Now that their habits are known, there is no reason why any nurseryman or gardener should send out infested plants when a bath will destroy all the pests and not damage the plants; and anyone who suspects their presence in a new purchase could soon ascertain whether they were there by dipping the pots.

At my request Mr. A. M. Lea, Government Entomologist to the Tasmanian Department of Agriculture, who is an authority on Australian Curculonidæ (weevil or snout beetles) has examined these beetles and decided that they belong not only to an undescribed species, but will not fit into any known genus. I herewith append his technical definition to the genus, and the description of the new beetle.

Neosyagrius, *n.g.*

Eyes small, ovate, distant, coarsely faceted. Rostrum moderately stout, slightly curved, the length of prothorax; scrobe wide and rather shallow, from its middle directed obliquely upward to both apex and base, the former visible from above, the latter touching eye. Scape inserted closer to apex than base of rostrum, rather strongly curved at base, apical half stout, feebly and widely grooved beneath, slightly shorter than funicle; two basal joints of funicle elongate (the second slightly the longer), the others very short; club briefly ovate, subsolid. Prothorax with ocular lobes just traceable. Scutellum absent. Metasternum much shorter than the following segment; episterna very narrow. Abdomen with basal segment almost as long as the three following combined, in middle soldered to the second; second shorter than fifth. Coxæ large, the two front pairs free, the first pair contiguous, the second separated by a small subquadrate (but its apex rounded) process, hind pair widely separated; femora rather stout,

edentate, feebly grooved, posterior not extending to apex of abdomen; tibiæ shorter than femora, feebly sinuous beneath, terminal hook small; tarsi rather thin, third joint wide and deeply bi-lobed; claws simple; body apterous.

An obscure genus of doubtful position but certainly allied to *Syagrius* (the two described species of which—*intrudens* and *fulvitarsis*—both attack ferns) and which has been referred to the *Molytides*. From *Syagrius* it can be readily distinguished by the scape, scrobe, rostrum, intercoxal process of mesosternum, and abdomen. From *Opsittus*, to which in some respects it appears to be rather close, it differs in the scrobe and scape. From *Psaldus*, and the other Australian genera referred to the *Molytides*, it is too distinct to need comparison.

Neosyagrius cordipennis, *n.sp.*

Black; antennæ and tarsi reddish-testaceous, rest of legs and apical segment of abdomen darker. Clothed with large soft scales varying from pale muddy-grey to sooty-black; dense on head and basal half of rostrum; a large scale (but not of uniform colour) in each prothoracic puncture and rising above the derm; elytra rather sparsely clothed, but the scales condensed along suture and on shoulders and forming two indistinct transverse fasciæ. Under surface with subsetose scales; legs more densely clothed, the femora indistinctly, or not at all, ringed with pale scales.

Head densely and coarsely punctate, but punctures more or less concealed; base finely transversely corrugated. Rostrum on basal half with punctures as on head, apical half rather finely punctate, apical portion of scrobes very distinct from above. Prothorax moderately transverse, base and apex of equal width, sides rounded with dense large rounded punctures. Elytra strongly cordate, base not much wider than prothorax, widest at basal third, thence rapidly diminishing in width to apex, each shoulder forming the middle of a rounded basal lobe; with large (almost foveate) punctures in regular series, the interstices moderately convex; sides beyond basal third strongly incurved, concave, glabrous, and polished, with irregular rows of large punctures. Length, $2\frac{3}{4}$ mm.

Habitat.—Sydney.

The decidedly heart-shaped elytra with strongly incurved and polished sides (not visible from above) should render this species easy of recognition. There are two specimens before me, in one of which the elytral fasciæ can be traced, but in the other they are absent.

The large Fern Weevil. (Syagrius fulvitarsis, *Pascoe.*)

THE habits of the beetle and larva are very similar to that of the last species except that they do not infest the maiden-hair ferns, but feed on the more fleshy leaf stalks of *Calipteris prolifera.* In these stems the scar made where the egg has been deposited is very distinct, and the larva hollows out the whole of the interior of the stalk as it works downward to the stem of the fern.

The beetle measures two lines in length, without including the stout snout turned down in front; its general colour is dull black, the thorax broadly rounded, and constricted at the junction with the body; the abdomen viewed from above elongate cylindrical, truncate at the tip; viewed from the side it is swollen out and the tip curved downwards. The whole of the integument very coarsely punctured. This species is not so numerous as the small weevil, but has been known about Sydney for many years, and is frequently confounded with the smaller species.

This weevil was described by Pascoe in a paper entitled "Additions to the Australian Curculonidæ," published in the Annals and Magazine of Natural History, Vol. 16, 1875, and was sent to him from Richmond River. Mr. Lea informs me that it has been recorded as a pest to ferns, but I have not seen the record.

The beetles could be taken in the same manner as the smaller weevil, but as the ferns are often so large it would be difficult to submerge them in water. The presence of the grub is much more noticeable on account of the scar on the stem, and the grub could often be picked out of the leaf stem with a knife point before it had seriously damaged the frond.

The Orchid Weevil. (Baris orchivora, *Blackb.*)

THIS little black weevil was bred from the pseudo bulbs or thickened leaf stalks of *Dendrobium canaliculatum,* specimens of which plant were sent to me by Mr. J. H. Maiden (Director of the Botanic Gardens) some years ago with the information that in overhauling a present of orchids, some plants had been found to be infested with a short white grub, which was feeding through the pithy centre and killing the leaves. As none have since been discovered it is evident that the prompt examination checked their introduction. An examination of the specimens received, showed several small black circular holes through which some of the beetles had evidently emerged, but the irregularly-gnawed passages traversing others contained larvæ, pupæ, and perfect beetles.

Several beetles were forwarded to the Rev. T. Blackburn of Adelaide, who pronounced them to be of a new species, and some time later he described the beetle under the name of *Baris orchivora,* in the transactions of the Royal Society of South Australia, 1900. The previously described species of this genus were until then described from South America.

The larva is of the usual short, thickened, wrinkled form, curled up in the burrow when at rest, with the head chestnut brown, lightest in the centre, where it is bisected by two darker lines, and is arcuate on the hind margin; jaws black, antennæ and palpi reddish brown. The pupa pale yellow with black eyes; the tip of the snout and spines on abdomen reddish brown with the wing-pads dark-coloured at the tips. The dorsal surface of the head smooth, bearing a few scattered hairs; thorax broad, showing a depression on either side and a central suture; the abdomen tapering to the extremity, each segment furnished with a spine on either side with the anal one bearing two, and a number of spiny hairs at the apex. The ventral surface shows several fine

hairs upon the head with two longer ones above the eyes; the snout and legs curled downwards, the wings folded down and forming a pad on either side. The pupa was at the end of the gnawed burrow without any regular cocoon except that the passage was closed with the gnawed fibre.

The beetle is a typical little black weevil, short and broad in proportion to its length, with the snout and legs thickened, the thorax broader than long, rounded on the sides to the hind margin, the elytron very convex and broadly rounded to the apex. The head is finely punctured, with the upper surface of the thorax more coarsely pitted and the wing covers marked with fine parallel punctured striæ, while on the under surface the segments and legs are also finely pitted. The beetle measures slightly over 2 lines in length. At a meeting of the Scientific Committee of the Royal Horticultural Society in London, in 1887, Pascoe exhibited a specimen of a live longicorn beetle, *Diaxenes Taylori*, which he had taken out of the stem of an orchid from Southern Burmah that had been introduced into England with the plant. This beetle is very roughly figured in the *Gardeners' Chronicle*, June 11, 1887.

A second species of the same genus (*Diaxenes dendrobii*, Gahan.) is very well described and figured in all stages of its life-history by Macdougall, who found them in several kinds of orchids in the Royal Botanic Gardens, at Edinburgh; *Gardeners' Chronicle*, July 24th, 1897.

The Advantages of Grinding the Whole Cob of Maize for Fodder.

From experiments that have been systematically carried out at several experiment stations, it would seem that where farmers make a practice of feeding ground corn it would be to their advantage to grind the whole ear, thereby utilising to excellent advantage what would otherwise constitute a waste product. The importance of corn and cob-meal has not been sufficiently recognised in the past. With more intensive methods of farming, we hope to see it occupy the place among stock foods which it rightly deserves. That it has a food value far beyond the possibilities indicated by its chemical analysis has been amply proved. There can be no question but that the value of the cob lies not within itself, but rather in its effect upon the corn fed in conjunction with it. Pure corn-meal is a heavy mass which tends to pack in the stomach of the animal, and hence prevent the proper action of the digestive juices. The ground cob has the effect of loosening and lightening this sodden mass, and the result is a more complete digestion of the corn, resulting in a higher total digestibility and a greater bodily gain per 100 lb. of feed consumed. The ground cob, too, tends to add bulk to the grain ration and to hinder its passage through the alimentary tract. This gives the digestive juices a chance to act more thoroughly by affording a longer time during which the food is subject to the action of the juices.—*Exchange.*

Co-operation for Farmers.

W. H. CLARKE.

In last issue Mr. Gosché gives an account of the manner in which the co-operative principle has been applied to the viticultural industry in certain districts of Germany and Italy, with an outline of the system and its operation. To what extent, and with what benefit to the farming community, could such a principle be adopted in a State like New South Wales, is a question that might well be considered by all concerned. With the object of opening up such a discussion, it is now proposed to offer a few suggestions, based upon ideas gathered from the perusal of reports of co-operative bodies in Europe and the United States.

Taking wheat as the leading farm crop, how would it be possible for farmers to co-operate, and to what extent would they find such organisation practicable and profitable, in the face of a multitude of different conditions of soil, climate, dates of maturity, and distances from market?

General Co-operation.

In the first place, the wheat-growers of the State might co-operate either in one huge central organisation or in a number of local ones, with the object of encouraging the use of the latest and most effective implements and machinery for the cultivation and harvesting of crops, and to secure such appliances at the lowest individual cost.

In the second place, growers might co-operate with the object of encouraging the cultivation in respective districts of the best commercial types of wheat, so that when the greater proportion of the wheat crops of the State has to go abroad for sale, as was the case last season and seems likely to be the case henceforward, the New South Wales grain may have the advantage of reaching the oversea markets in a few uniform types representing a large bulk of each and not, as at present, go into competition with graded wheats as a miscellaneous collection of small lots of varying character.

This carries the co-operative system to the grading stage; and in this matter of grading lies the success or failure of New South Wales wheat-growers to find a permanent footing in the big oversea markets. From all that one can learn of the manner in which the grain from Canadian, United States, and Argentine farms goes to market, it seems pretty certain that unless the New South Wales method of shipping wheat is brought up-to-date, the export trade will not be the means of returning much profit to the farmer.

The following is what a disinterested observer who has lately been watching the operations of the London grain trade says: "When an American or Canadian farmer sends his wheat to market, a child can buy it. Grading has given it a definite value. According to the

grade, it is worth so much per bushel. There is no mistake about that, for it is to the interest of the farmer all the time to have a definite value set on his product. There is no gambling in it then. Whenever there is gambling in any produce, it is the producer who has to suffer. When a man buys 'Manitoba No. 1,' he knows what he is getting, and the seller knows what he is selling; but with Australian or Russian wheat or grain, it takes a man to be up early in the morning to make money, and all he makes comes off the producer. At least, most of it does; but the trade objects to the grading, so the farmer ought to insist upon it."

In this State, the farmer, through lack of co-operation, or something akin to it, does not stand in the position of being able to know what are the types of wheat which command most money in the oversea markets; to know absolutely that the wheat he sows is of the variety which, for the conditions of his district, is one that comes within the range of those commercially valuable types, and that it is the best and purest seed procurable. It might seem at first glance that the help he could get from a co-operative association of wheat-growers in matters of this kind might be a bit vague. But just let us see how the help would be managed. The co-operative body, dealing as one big business concern, would have the advantage of being able to go to any market and offer to fulfil, not by little fitful shipments, but by a steady stream of considerable volume, the requirements of buyers who operate in various classes of wheat because the trade they buy for have the machinery and plant for handling those types, and do not want anything else. With the assurance of ability to do this, the representative of a co-operative wheat-growers' concern would have a recognised standing in any big market, and he would soon learn exactly what buyers were ready to pay the best prices for. With such information, the executive of a co-operative concern could arrange to procure, with all the trade concessions accruing to large operations, quantities of seed of the approved varieties, take steps to ascertain that they are of the purest strains, grade and clean them, and then distribute the grain according to the districts for which each of the respective varieties is best adapted.

In carrying out such a work it would be found that hundreds of farmers are growing, and have been growing, precisely the right types for their local conditions and for market purposes. While such would need no new seed or other assistance, they would have the satisfaction arising from definite assurance that they are on the right track. At the end of the season, or, indeed, at the earliest stage upon which a forecast of the harvest might with safety be made, the co-operation management would be in a position to know, with sufficent accuracy for practical purposes, what sorts of wheat and how much of each would be available for shipment; and, armed with this information, they would be in a position to enter into businesslike negotiations with buyers in the respective markets where each class of wheat is in most demand. They would also be able, as a co-operation, to handle and transport the grain at a minimum cost, and thus leave to the grower a wider margin of profit.

From such co-operation, as roughly outlined, everyone interested in the wheat industry would benefit—the farmer because his means of production would be cheapened, his market facilities increased, and his margin of profit widened; the miller, because he would be able to obtain with greater facility and certainty the particular types of wheat necessary for the requirements of his machinery and his trade; the wheat dealer, because he would know what he was buying and how much of any special line he could depend upon obtaining to fill his orders; the Railway Commissioners, who would have one authentic source of information as to the season's carriage, and would have a regulated volume of grain to provide for instead of an intermittent stream; the shipping companies, who could, under arrangements that a co-operative body could make, enter into contracts for freights without finding it necessary to impose a rate high enough to cover risks of delay that are always likely to arise from the individual handling of a product from innumerable sources; and last, but not least, the buyer, before whom other big wheat-producing countries are only too eager to attractively display their grain, could be given the necessary guarantee, not only of quality, but of quantity, without which he is disinclined to look at any parcels of wheat.

Local Co-operation.

There are many other forms of co-operation that might be practised among growers, but they are really more adapted for local application on a small scale. For instance, it often happens that a group of farmers whose operations are at present upon too small a scale to warrant the purchase of such useful machinery as a multiple furrow or disc plough, a seed and manure drill, a reaper and binder or other appliances, have to each work against almost overwhelming odds with crude and expensive methods. Now while the machinery essential to economical production might be beyond the reach of any individual of that group, each might be able to secure at least one up-to-date machine or implement, and by means of co-operation a first-rate and effective plant for the working of the land and the harvesting of the crops could be made available for the use of all the farmers composing the group. It is a curious fact that whenever one speaks of such a means of enabling the struggling man to throw off some of the handicaps that hamper his methods of production, somebody jumps up to say how unworkable such a plan would be—that, in the matter of ploughs for instance, everybody would want the first use; that the implements would get knocked about and last no time; that the man whose turn came last would have his crop in so late that the yield would suffer—all sorts of calamities are predicted, and thousands of reasons are advanced to prove beyond the faintest shadow of doubt that the whole system would burst up before the first season's work was finished—which is all more or less speculative. At any rate, co-operation of this kind has been so little practised in this State, that nobody can say from more than supposition that it will fail. Let us us see how it might work. At Bringabagoflouralong say, there are, with their holdings closely situated,

half-a-dozen farmers and their families settled. The district is one in which the staple crop is wheat for grain. Each farmer is cultivating, say, on an average 150 acres. That means, that if they were to co-operate in securing up-to-date working plant, there would have to be provision for ploughs to cope with a total area of 900 acres. The ploughing season extends, say, from beginning of March to end of May—twelve weeks—according to the conditions of the district. Experience has proved that it is desirable that the wheat for hay should be sown not later than the end of March, and for grain not later than the close of May. If each man works independently and does his own ploughing with his own implements and teams, it means that, to keep within these dates and thus ensure a fair return, each will have to use either two single-furrow ploughs and four or five horses, or one double-furrow plough and three or four horses, and will have to slog-in without intermission for the whole twelve weeks to barely get through, when all the allowances for weather, bad shoulders, &c., are made. This makes, for the six holdings, the employment under what might be said to be the most usual conditions of equipment of small farms—a double-furrow plough and three or four horses, with a driver—of six men, six ploughs, and twenty-four horses continuously for the whole of three months.

If by co-operation more effective means of preparing the land for the reception of the seed could be used, it is at least reasonable to suppose that the whole acreage embraced by the six cultivation paddocks could be made ready in much less time and at less expense per acre, and thus all six farmers would be more certain of being able to avoid late sowing. But in the preparation of the land the advantages arising from co-operation are small compared with the saving and security of harvesting by means of a large co-operative outfit. It is quite possible that the procedure likely to prove most profitable in the cultivation of 150 acres of wheat would be to trim, say, 10 acres around the edges of the crop for wheaten hay, then to use the reaper and binder until the crop is dead ripe, when it could be most expeditiously garnered by means of the stripper. It is more than likely, however, that a man whose main source of income is derived from 150 acres of wheat could not afford to indulge in both a reaper and binder and stripper. Thus, he must, working solely on his own resources, either adopt *in toto* the speedier method of stripping, and practically lose all his straw, or he must run the risk of over-ripeness and shedding to which the crop is exposed in the slow process of harvesting with a single reaper and binder.

With co-operation, the group of farmers could secure a harvesting plant capable of expeditiously treating a 900-acre crop at less individual expense than each could get a complete plant for his own 150 acres; and in making this assertion the fact is not overlooked that it is, of course, cheaper to work 900 acres in one block than it is to work what practically amount to twelve blocks of ripening and ripe grain on six farms. Then, in the sowing of the seed, where the individual may not see his way to the acquisition of a seed drill, a co-operative body could secure a couple of drills of the very best type, and all could use

and benefit by them at a third of the expense. In the same way, a grading machine could be acquired, and the members of the co-operative body could secure all sorts of concessions in the purchase of manures, &c., on a large scale that are not possible to the man who stands alone.

Co-operation in minor lines.

What applies to wheat will apply more or less to nearly all other crops. The wheat farmer is generally well advised to go in for a small flock of sheep and a few pigs, turkeys, horse-breeding, fruit-growing and other side lines that may stand him in good stead in the advent of bad seasons for wheat, and be an additional source of income all the time. When a man can raise only a few sheep, or a few pigs, or a few turkeys, he must make up in quality for market what he lacks in quantity. To do this means the acquisition of valuable sires, and in this particular direction co-operation could be availed of to very great advantage indeed. If half a dozen farmers each set out to keep a few brood sows there is not much use in each striving to acquire a boar of, perhaps, indifferent value. The far better course would be to club together and get a really good one that would improve the market quality of the progeny. The same thing applies to the small flocks of farm sheep for which none but the best of Shropshire rams can be profitably used. Whole communities of wheat farmers might derive a very considerable return every year from the rearing of high-grade turkeys. Lots of men see that there is money in the business. They do not care to go in for it, however, because to get the best paying results one has to invest £5 or £6 in a gobbler. To a number of farmers in co-operation such a sum would be insignificant. In making these suggestions one cannot help feeling that what, for want of a more explicit term, is generally called "human nature" has to be reckoned with as a big factor. But in other countries, farmers whose produce often knocks ours down into the bottom rows of the price lists have co-operated, and although there may be in every district of this State, as there are everywhere else all over the universe, some people who cannot see any advantages in men working together for the advancement of their mutual interests, there are no doubt many who do; and the question is whether, for the sake of the few who do not want to progress, those who do should be content to sit down and see the products of this State which, at their best, have no superior, always relegated to the back benches of the world's markets.

Diseases of the Horse.

THERE has been received from the Bureau of Animal Industry of the Department of Agriculture of the United States a very valuable work on the Diseases of the Horse. The work has been prepared by the leading veterinarians of the United States, each contributor dealing with the class of disease in which he is most experienced and expert.

It is thought that readers of the *Gazette* may appreciate some extracts from this work, and as the disease of the horse that is most frequently met with is what is termed colic, it is now proposed to reproduce some particulars concerning this trouble and the means that can be adopted to prevent or remedy it. The disease is dealt with under the heading of *Diseases of the Digestive Organs* by Mr. C. B. Michener, V.S., and his work has been recently revised by Mr. Leonard Pearson, B.Sc., V.M.D.

The term colic is applied loosely to almost all diseases of the organs of the abdomen that are accompanied by pain. If the horse evinces abdominal pain, he is likely to be put down as suffering with colic, no matter whether the difficulty be a cramp of the bowel, an internal rupture, overloading of the stomach, or a painful disease of the bladder or liver. Since these conditions differ so much in their causation and nature, it is manifestly absurd to treat them alike and to expect the same drugs or procedures to relieve them all. Therefore it is important that the various diseased states that are so roughly classed together as colic shall, so far as is possible, be separated and individualised in order that appropriate treatments may be prescribed. With this object in view, Messrs. Michener and Pearson discuss the colics under the following headings :—Engorgement colic, obstruction colic, tympanitic colic, spasmodic colic, worm colic.

For the purposes of the man who simply wants to know what is the best thing to do when his horse takes bad, it is perhaps not necessary to follow exactly the order laid down by the authors ; and therefore, in the references to the more intricate troubles, such as rupture of the stomach, foreign bodies in the stomach, intestinal concretions, invagination, twisting of the bowels, paralysis of the intestines, where the services of a qualified veterinarian are indispensable, only the symptoms will be described. This, it is thought, will be sufficient to indicate when expert assistance must be obtained.

General Symptoms of Abdominal Pain.

The general symptoms of abdominal pain, and therefore of colic of all kinds, are restlessness, cessation of whatever the horse is about, lying down, looking around at flank, kicking with the hind feet upward and forward towards the belly, jerky switching of the tail, stretching as though to urinate, frequent changes of position, and groaning. In the more intense forms the horse plunges about, throws

himself down, rolls, assumes unnatural positions—as sitting on the haunches and grunting loudly. Usually the pain is not constant, and during the intermissions the horse may eat and appear normal. During the period of pain the horse may sweat freely. Sometimes he will move in a circle. The respirations are accelerated, and usually there is no fever.

Engorgement Colic.

This form of colic consists in an overloading of the stomach with food. The horse may have been overfed, or the food may have collected in the stomach through failure of this organ to digest it and pass it backward into the intestines. Even a normal amount of food that the horse is unaccustomed to may cause disease. Hence a sudden change of food may produce engorgement colic. Continued full rations while the horse is resting for a day or two, or working too soon after feeding may serve as a cause. New oats, maize, or hay, damaged food, or food difficult of digestion, such as barley or beans, may incite engorgement colic. This disease may result from having fed the horse twice by error, or from its having escaped and taken an unrestricted meal from the grain bin. Ground feeds that pack together making a sort of dough may cause engorgement colic if they are not mixed with cut hay. Greedy eaters are predisposed to this disease.

Symptoms of Engorgement Colic.

The horse shows the general signs of abdominal pain, which may be long continued or of short duration. Retching or vomiting movements are made; these are shown by laboured breathing, upturned upper lip, contraction of the flank, active motion at the throat, and drawing in of the nose toward the breast, causing high arching of the neck. The horse may assume a sitting position on his haunches, like a dog. At times the pain is very great, and the horse makes the most violent movements, as though mad. At other times there is profound mental depression, the horse standing in a sleepy, or dazed, way with the head down, the eyes closed, and leaning his head against the manger or wall. There is, during the struggles, profuse perspiration. Following retching, gas may escape from the mouth, and this may be followed by a sour froth and some stomach contents. The horse cannot vomit except when the stomach is violently stretched, and, if the accumulation of food or gas is great enough to stretch the stomach so that vomiting is possible, it may be great enough to rupture this organ. So it happens not infrequently that a horse will die from ruptured stomach after vomiting. But after the stomach ruptures vomiting is impossible. The death-rate in this form of colic is high.

Treatment.

The bowels should be stimulated to contraction by the use of clysters of large quantities of water and of glycerine. Veterinarians use hypodermic injections of eserin or arecolin or intravenous injections of barium chloride, but these have to be employed with great caution. It is not profitable to give remedies by the stomach,

for they cannot be absorbed; but small doses of morphine (5 grains) or of the fluid extract of Indian hemp (2 drams) may be placed in the mouth and are absorbed in part, at least, without passing to the stomach. These drugs lessen pain, and thus help to overcome the violent movements that are dangerous, because they may be the means of causing rupture of the diaphragm or stomach. If facilities are available, relief may be afforded by passing an esophageal tube through which some of the gaseous and liquid contents of the stomach may escape.

Flatulent Colic (Tympanitic Colic, Wind Colic, or Bloat).

Among the most frequent causes of this form of colic are to be mentioned sudden changes of food, too long fasting, food when given while the animal is exhausted, new hay or grain, large quantities of green food, food that has lain in the manger for some time and become sour, indigestible food, irregular teeth, crib-biting, and, in fact, anything that produces indigestion may produce flatulent colic.

Symptoms.

The symptoms of wind colic are not so suddenly developed nor so severe as those of cramp colic. At first the horse is noticed to be dull, paws slightly, and may or may not lie down. The pains from the start are continuous. The belly enlarges, and by striking it in front of the haunches a drum-like sound results. If not soon relieved the above symptoms are aggravated, and in addition there are noticed difficult breathing, bloodshot eyes, and red mucous membranes, loud tumultuous heart-beat, profuse perspiration, trembling of front legs, sighing respiration, staggering from side to side, and, finally, plunging forward dead. The diagnostic symptom of flatulent colic is the distention of the bowels with gas, detected by the bloated appearance and resonance on percussion.

Treatment.

The *treatment* for wind colic differs very materially from that of cramp colic. Absorbents are of some service, and charcoal may be given in any quantity. Relaxants and antispasmodics are also beneficial in this form of colic. Chloral hydrate not only possesses these qualities, but it also is an antiferment and a pain reliever. It is then particularly well adapted to the treatment of wind colic, and should be given in the same sized doses (1 oz. in a pint of water as a drench) and in the manner directed for spasmodic colic. Diluted alcohol or whisky may be given, or aromatic spirits of ammonia in 1 oz. doses at short intervals.

A physic should always be given in flatulent colic as early as possible, the best being Barbados aloes in the dose mentioned (1 oz.) Injections, per rectum, of turpentine 1 to 2 oz., linseed oil 8 oz., may be given frequently to stimulate the peristaltic motion of the bowels and favour the escape of wind. Blankets wrung out of hot water do much to afford relief; they should be renewed every five or ten minutes and covered with a dry woollen blanket. This form of colic

is more likely to be fatal than cramp colic, and requires prompt and persistent treatment. It is entirely unsafe to predict the result, some apparently mild attacks going on to speedy death, while others that appear at the onset to be very severe yielding rapidly to treatment. Do not cease your efforts until you are *sure* the animal is dead. In these severe cases puncturing of the bowels in the most prominent (distended) part by means of a small trocar and canula, or with a needle of a hypodermic syringe, thus allowing the escape of gas, has often saved life, and such punctures, if made with a clean, sharp instrument that is not allowed to remain in the horse too long, are accompanied by little danger, and do more to quickly relieve the patient than any other treatment.

Spasmodic, or Cramp, Colic.

This is the name given to that form of colic produced by contraction, or spasm, of a portion of the small intestines. It is produced by indigestible food; large drinks of cold water when the animal is warm; driving a heated horse through deep streams; cold rains; drafts of cold air, &c. Unequal distribution of or interference with the nervous supply here produces cramp of the bowels, the same as external cramps are produced. Spasmodic colic is much more frequently met with in high-bred, nervous horses than in coarse, lymphatic ones.

Symptoms.

These should be carefully studied in order to diagnose this from other forms of colic requiring quite different treatment. Spasmodic colic always begins suddenly. If feeding, the horse is seen to stop abruptly, stamp impatiently, and probably look back. He soon evinces more acute pain, and this is shown by pawing, suddenly lying down, rolling, and getting up. During the period of pain the intestinal sounds, as heard by applying the ear over the flank, are louder than in health. There is then an interval of ease; he will resume feeding and appear to be entirely well. In a little while, however, the pains return, and are increased in severity, only to again pass off for a time. As the attack progresses these intervals of ease become shorter and shorter, and pain may be continuous, though even now there are exacerbations of pain. Animals suffering from this form of colic evince the most intense pain; they throw themselves down, roll over and over, jump up, whirl about, drop down again, paw, or strike rather, with the front feet, steam and sweat, and make frequent attempts to pass their urine. Only a small amount of water is passed at a time, and this is due to the bladder being so frequently emptied. These attempts to urinate are often regarded by horsemen as symptoms of trouble of the kidneys or bladder. In reality they are only one of the many ways in which the horse expresses the presence of pain. As a matter of fact, diseases of the bladder or kidneys of the horse are exceedingly rare.

To recapitulate the symptoms of spasmodic colic: Keep in mind the history of the case, the type of horse, the suddenness of the attack,

the increased intestinal sounds, the intervals of ease (which become of shorter duration as the case progresses), the violent pain, the normal temperature and pulse during the intervals of ease, the frequent attempts to urinate, &c., and there is but little danger of confounding this with other forms of colic.

Treatment.

Since the pain is due to spasm, or cramp, of the bowels, medicines that overcome spasms—antispasmodics—are the ones indicated. Chloral hydrate may be used. This is to be given in a dose of 1 oz. in a pint of water as a drench. As this drug is irritant to the throat and stomach, it has to be well diluted. A common and good remedy is sulphuric ether and laudanum; of each 2 oz. in a half-pint of linseed oil. Another drench may be composed of 2 oz. each of sulphuric ether and alcohol in 8 oz. of water. If nothing else is at hand give whisky, one half-pint in hot water. Jamaica ginger is useful. If relief is not obtained in one hour from any of the above doses, they may then be repeated. The body should be warmly clothed and perspiration induced. Blankets dipped in very hot water, to which a small quantity of turpentine has been added, should be placed around the belly and covered with dry blankets, or the abdomen may be rubbed with stimulating liniments or mustard water. The difficulty, however, of applying hot blankets and keeping them in place forces us in most instances to dispense with them. If the cramp is due to irritants in the bowels, a cure is not complete until there is given a cathartic of 1 oz. of aloes or 1 pint of linseed oil. Injections into the rectum of warm soapy water or salt and water aid the cure.

Rectal injections, clysters, or enemas, as a rule should be lukewarm, and from 3 to 6 quarts are to be given at a time. They may be repeated every half hour if necessary. Great care is to be taken not to injure the rectum in giving such injections. A large syringe or a piece of rubber hose 4 or 5 feet long, with a funnel attached at one end, affords the best means by which to give them. The pipe of the syringe or the hose introduced into the rectum must be blunt, rounded, and smooth. It is to be thoroughly oiled and then carefully pushed through the anus in a slightly upward direction. Much force must be avoided, for the rectum may be lacerated and serious complications, or even death, result. Exercise will aid the action of the bowels in this and similar colicky troubles, but severe galloping or trotting is to avoided. If the horse can have a loose box or paddock, it is the best, as he will then take what exercise he wants. If the patient be *extremely* violent, it is often wise to restrain him by leading him with a halter, since rupture of the stomach or displacement of the bowels may result and complicate the trouble.

Indigestion, or Gastro-Intestinal Catarrh.

There is ample reason for considering these conditions together from the facts that they merge insensibly into each other, and usually occur simultaneously. This condition may be acute—that is, of sudden

onset—or it may be chronic. The changes of structure produced by this disease occur in the mucous-membrane lining of the stomach and intestines. This membrane becomes red from increased blood supply or from hemorrhage into it, it is swollen, and is covered by a coating of slimy mucus. In some especially severe cases the membrane is destroyed in spots, causing the appearance of ulcers or of erosions.

The causes of indigestion are numerous, but nearly all are the result of errors in feeding.

Some horses are naturally endowed with weak digestive organs, and such are predisposed to this condition. Anything that irritates the stomach or intestines may cause this disease. Foods that the animal is unaccustomed to, sudden changes of diet, imperfectly cured, unripe, or damaged foods, are all fruitful causes, and so are worms. In suckling foals this condition may come from some disease of the dam that renders her milk indigestible, or from over-exertion or over-heating of the mare. Another prolific cause is bad teeth, making mastication imperfect, and thus causing the horse to swallow his food in a condition unfit for the action of the digestive juices. Working a horse too soon or too hard after feeding may cause either colic or indigestion. Any condition that reduces the vitality of the horse, such as disease, overwork, poor food, or lack of care, may indirectly bring on indigestion by weakening the digestive organs.

Symptoms.

Indigestion is characterised by irregular appetite; refusing all food at times, and at others eating ravenously; the appetite is not only irregular, but is often depraved; there is a disposition on the part of the horse to eat unusual substances, such as wood, soiled bedding, or even his own feces; the bowels are irregular to-day, loose and bad smelling, to-morrow bound; grain is often passed whole in the feces, and the hay passed in balls or impacted masses, undergoing but little change; the horse frequently passes considerable quantities of wind that has a sour odour. The animal loses flesh, the skin presents a hard, dry appearance, and seems very tight (hidebound). If the stomach is very seriously involved, the horse may yawn by stretching the head forward and upward and by turning outward the upper lip. There may be more or less colicky pain. In the chronic cases there is mental depression; the horse is sluggish and dull. The abdomen gradually becomes small, giving a "tucked-up" appearance, or on the other hand, it becomes flaccid and pendulous.

Treatment.

One should commence with the food—its quality, quantity, and time of feeding; examine the water supply, and see, besides, that it is given before feeding; then carefully observe the condition of the mouth and teeth; and, continuing the observations as best we may, endeavour to locate the seat of the trouble. If the teeth are sharp or irregular they must be rasped down; if any are decayed they must be extracted; if indigestion is due to ravenous eating or bolting, the feed

must then be given from a large manger where the grain can be spread and the horse thus compelled to eat slowly.

Any irritation, such as worms, undigested food, &c., that are operating as causes are to be removed by appropriate treatment—for worms, a drench of 1 oz. turpentine and 2 or 3 oz. linseed oil, after a long fast at first, and continued twice daily for three days, to be followed on the fourth day by 1 oz. Barbadoes aloes; for purgative, try first a change of diet to bran mashes, linseed gruel, and green stuff (fed carefully). If there is a tendency to distention of the stomach and bowels with gas during indigestion, the following may be used: Baking soda, powdered ginger, and powdered gentian, equal parts. These are to be thoroughly mixed and given in heaping tablespoonful doses, twice a day, before feeding. This powder is best given by dissolving the above quantity in a half-pint of water, and given as a drench.

As a digestive tonic the following is good: Glauber's salts, 2 lb.; common salt, 1 lb.; baking soda, one-half lb. Of this a heaping tablespoonful may be given in each feed. If diarrhœa exists, unless the horse has a natural tendency to scour, try wheat-flour gruel, or 2 to 3 oz. castor oil or raw linseed oil, before resorting to severe astringents.

Sisal Hemp.

In answer to inquiries with regard to the growth of sisal hemp, Mr. C. H. Gorman, manager of the Experimental Farm, Wollongbar, states:—"Sisal hemp will grow in almost any soil, but a good loamy one is the best for it. A warm climate is essential. The fibre is easily extracted with machinery. At Wollongbar a Ramie decorticator machine is used, but more suitable appliances than that can be obtained in England. It takes from two to three years for the plants to mature, according to seasons. In the Richmond River district a harvest can generally be made in two years from planting the suckers.

About 30 lb. of leaf is required to make 1 lb. fibre. Twenty leaves per plant is the best return obtained at this farm so far. A leaf will weight from 2½ to 3 lb., so that the weight of leaf per plant will be approximately 50 lb. to 60 lb., representing from 1⅔ lb. to 2 lb. fibre per plant. Allowing for waste in extracting fibre and grading, a fair amount might be put at 1¼ lb. fibre per plant.

The best distance to plant, 5 feet by 5 feet, gives 1,742 plants per acre, so that the product per acre, represented by an all-round average of 1½ lb. clean fibre per plant, will be, approximately, 1 ton 3 cwt. 1 qr. 9 lb.

A few suckers of sisal hemp will be shortly available at Wollongbar Farm for distribution.

Forestry.

Suitability of New South Wales Timbers for Wood-paving.

INQUIRY having recently been instituted regarding the use of New South Wales hardwoods for wood-paving in other countries, the following replies received by the Department of Forestry will be of public interest, indicating as they do the satisfactory character of the tests applied and the suitability of these timbers for wood-paving purposes under conditions foreign to their extensive use in the city of Sydney.

From the City Engineer, Vancouver, British Columbia, under date 11th December, 1902:—

. . . I have the honor to report that I have examined the wood block paving of Australian wood (this was presented by the New South Wales Government to the authorities at Vancouver in 1894) laid down under my supervision in 1894 on the north end of Granville-street, at the approach to the C.P.R. Station, and find the condition of the blocks as follows:—

(1) None of the blocks show any appreciable evidence of wear after eight years' service.

(2) The red mahogany and spotted gum blocks are perfectly sound, and practically in as good condition as when laid.

(3) The blackbutt blocks show a little decay on the bottom ends, extending upwards about $\frac{1}{8}$th of an inch.

Owing to the steep grade, 8 per cent. of these blocks were laid with a strip between them at the bottom, filled in with fine gravel and pitch; the heavy traffic, however, does not appear to have even worn the edges. . . .

From the City Road Surveyor, Roads Department, Edinburgh:—

. . . Blackbutt paving blocks. Up to the present time these blocks have given fair satisfaction, and although slightly abraded on the joints and surface this is not to be wondered at, seeing the large amount of heavy traffic which has passed over it during the past five years. The other hardwoods I have used are Jarrah and Karri (West Australian). I have not used any forest mahogany. . . .

From the City Engineer, Lincoln:—

. . . Blackbutt. In reply to your inquiry respecting this wood, I have to state that I laid some down in our main street, High-street, in August, 1897. It has worn and is wearing well, and I consider it a good wood for paving streets. . . .

From Commercial Agent, London:—

. . . I may also mention that when in Hamburg last year I ascertained that experimental pavements had been laid there with blackbutt, tallow-wood, spotted gum (New South Wales woods), and jarrah and karri (West Australian woods), and the Chief Engineer of the City informed me that so far tallow-wood had proved the most satisfactory. He added what the Minister for Public Works had also told me, that he regarded Australian hardwood as superior to anything else for street paving, the extra initial cost being the only difficulty. . . .

Some Practical Notes on Forestry Suitable for New South Wales.

By J. H. MAIDEN,
Government Botanist and Director of the Botanic Gardens, Sydney.

III.

Fencing.

It is obvious that in many cases it is useless to proceed with tree-planting unless the land be fenced. The nature of the fence must, of course, vary according to the materials available and to local circumstances. It is, therefore, impossible to go much into detail. In most cases it is sufficient to put a strong wooden two-railed fence round the land. Where there are sheep, hares, or rabbits further protection is, of course, necessary. If the planting be more or less round the edge of the land, like a frame to a picture, as in most parks, where it is necessary for the centre of the park to be available for games or for grazing, an inner fence is necessary, which may (according to the animals grazing) be light in appearance; it must certainly be neat, or it will be offensive to those within the park. A light wire-fence with droppers is frequently sufficient. A third form of fencing is that of the tree-guard, which is usually a luxury, and generally only for the protection of single trees, though, in the case of boulevards, two or more may be protected by the same guard. For well-to-do municipalities and organisations and private persons there is nothing to equal the tree-guard made of half-inch round iron, the rails set longitudinally and bound together in two semi-circles which can be clamped together. By means of bolts and screws the tree-guard can thus be taken apart for the purpose of repainting the inside, of repairing bent rails, or of removing it altogether when the tree is large enough to do without protection. Neat tree-guards are also made of picket fencing or wooden frames over which wire-netting is stretched. Some are triangular, others square in section. It is highly undesirable, both for appearance sake, and also for the welfare of the tree, to have tree-guards made of close wooden fencing. The enclosed tree becomes tender and drawn up to the light, and immediately it tops the enclosure it is blasted by the prevalent wind.

Preparation of the Ground.

The amount of preparation the ground will receive must depend on the object of the plantation. If a large number of forest trees are being put out in virgin or nearly virgin soil, rough and ready methods must be adopted as compared with the laying out of a garden or ornamental plantation, or road-side planting within a municipality. In trenching ground for new plantations of trees and shrubs, if in virgin soil, a depth of 20 inches to 2 feet is considered sufficient, but this may be varied according to circumstances. If there is only a thin layer of good soil on the surface, it should not be buried at the bottom of the trench, as the roots might never reach it.

Better have all the soil of a homogeneous nature, and suitable to the trees to be planted, or made so by the addition of good loam, &c.

In trenching ground by manual labour, only pick and shovel should be used. The ground should be picked and loosened to the full depth required, a little at a time, and shovelled back, thus getting thoroughly mixed in the operation.

In preparing large areas for tree culture, a good ordinary plough, followed by a subsoil or trench plough drawn by several horses or bullocks, is more economical, and will answer all purposes better than the usual manual style of trenching.

In Avenue and Boulevard planting, the ground should be always prepared in long strips, never separate holes or spaces. The broader the strip the better, but 6 feet may be taken as a minimum. In this case horse or bullock teams should certainly be employed in conjunction with manual labour; and 2 feet should be taken as the minimum depth of trenching, or rather sub-soiling, as the sub-soil from the bottom of the trench should never be taken to the top. Properly equipped ploughs will turn over or loosen the surface to a depth of 15 inches, while relays of men, each having a short section of furrow after the plough, with suitable tools, will loosen and stir the ground to a depth of 9 inches or more (without bringing it to the top). If the subsoil is unsuitable, as for example where we have pipe clay, clay slate, silt, or pure sand, &c., this bad soil should be removed, and the ground afterwards made up to a proper level with good soil from some other source.

In the case of rocky ground, a different system must be followed, as the rock must be quarried out to a depth of 2 feet or more, and the ground filled in with suitable loamy soil.

In preparing ground for street planting, where it is impossible to open the ground in strips, as for example, if the subsoil is gravelly or dry, a hole 5 feet in diameter opened 20 inches deep should be made, and good loam added as required. If the subsoil be clay or wet, the holes should be connected with stone drains, with an outlet at the lowest tree to convey away the surplus water.

It should be remembered that a tree is like an animal in that it requires nutriment. If the soil is very poor it should be removed, or, at least, enriched. To plant trees in hungry soil is a waste of time and money. A tree is responsive to proper treatment.

Notes on Conservation and Reafforestation.

Recently the Minister for Lands sought the opinions of the staff of district foresters on the subject of conservation and reafforestation. From a set of interesting reports furnished, the following is a synopsis of the suggestions offered:—

Administration of Forest Lands.—Conservation begins with the classification of forest lands. Conservation and settlement cannot go

hand in hand, and the key to successful conservation and reafforestation is the dedication of forest lands in perpetuity, and their administration in the interests of timber supply.

Suggestions on Conservation.—The first aids to conservation are the limitation of ringbarking, discouragement of settlement on lands suitable for the growth of timber, and the prohibition of felling of immature timbers. Following on this, much may be done by squaring timber with the saw in place of hewing, by encouraging the working up of waste timber for minor purposes, and by stricter supervision of improvement lease operations and the prohibition of use of fire in carrying out same.

Suggestions on Reafforestation.—The first aids to reafforestation are judicious destruction of over-mature and non-commercial species, the clearing up of *debris* and other checks on the spread of bush fires, the provision of periods of rest and withdrawal from occupation and grazing of forest areas that have been over-denuded. Planting is not a necessity, except in the case of very few indigenous species.

Forests to Prevent Floods.

A serious change has been brought about in Eastern Roumelia by the great destruction of trees. In the basin of the River Ergene, the largest tributary of the Maritza, the forests which used to occupy 770 square miles occupy now barely the odd 70 miles. The consequence has been seen in the enormous rise of the Maritza, which now carries away the water that the forests used to absorb. Flood level has risen to an alarming degree, and great damage is now done by the flow of the stream. In spring, when the floods occur, the whole valley is often under water, the bridges even being quite impassable. The agricultural value of the neighbouring land is likewise affected by the disappearance of the trees, says *Science Siftings*.

The Grading of Grain.

In grading commercial grain there are two classes of elements taken into consideration by the graders, who work under the rules laid down by the United States Chief Grain Inspectors' National Association. First, those which indicate condition—moisture, percentage of mouldy, rotten, or otherwise damaged kernels, and percentage of broken grains, dirt, and other foreign material; and, second, those which indicate quality—colour, plumpness, relative proportion of starchy to hard material, and relative size of germ.

Moisture, percentage of colours in mixtures, percentage of damaged grains, and percentage of broken grains and dirt are regarded as essential elements in determining the grades.

The Culture of Fresh-water Fishes.

ALBERT GALE.

THERE are certain classes of fish of which some varieties live in salt water, others in brackish water, and others again in purely fresh water. Among fresh-water fishes, some varieties will live only in running waters and others in stagnant or still waters. Some fish spend portion of their life in salt water and the other portion in fresh water—a constant migration from salt seas to fresh water rivers.

The rapid mountain torrents that some fish revel in would be death to those whose habitat is the stagnant water of weedy ponds and *vice versa*.

Since writing on the culture of fresh-water fishes, I have received many communications from the different parts of this State with respect to the subject under review, some inquiring after a supply of aquatic plants wherewith to prepare their ponds for the reception of finny inhabitants, others asking for a supply of fish wherewith to stock waterholes where all the natural conditions exist. All I can say in reply to the latter is that at present there are not available for distribution varieties of fishes I have elsewhere mentioned as suitable for pond culture. The fish that the greatest interest has been taken in, as it regards acclimatisation in this State, are a few varieties of the salmon family, chiefly the rainbow trout, and these do not take readily to the confinement of stagnant water. From the Chairman of the Fisheries Board I have been assured that the time is close at hand, and efforts are being made for the introduction of fish from Europe and America suitable for the purpose of stocking waterholes where the conditions are suitable. So far, my advice to those who write for a supply of live fish for the purposes required is that from the fresh waters near to their homesteads they should capture a few fish, say, about half a dozen wherewith to stock their ponds.

Amongst our indigenous fishes that thrive and multiply very rapidly is the Murray cod. These are to be met with in all the rivers of the west and the tributaries thereto. The late Mr. Wilcox of Grafton, who was an excellent authority on the subject, once informed me that the Murray cod was to be met with in the waters of the Upper Clarence. These were not exactly of the same variety as those of the Murray. Several times I have fished the tributaries in the upper portion of the water-shed of that river, but failed to obtain a specimen.

The Murray cod bears transportation well and will soon adapt itself to its new home. Many years ago the late Sir Terence Aubrey Murray introduced this fish from the tributaries of the Queanbeyan River to Lake George. In a few years the lake and creeks, emptying themselves therein, were fairly well stocked with cod. The people living near

this lake soon had their larders well stored with these fish which was a decided change from the everlasting mutton. From Lake George some of the descendants of the fish that were introduced there were carried to the waters of the Wollondilly River and the Mulwarree Ponds near Goulburn. The Wollondilly River is the name given to the upper portion of the Hawkesbury River, and there is nothing, therefore, to prevent the Murray cod from becoming an inhabitant of fresh waters of the last-named river and its tributaries. Amongst other fish, and indeed among themselves, cod have very destructive characters, greedily devouring any fish that comes in their way. Nevertheless, nearly all kinds of fishes are equally destructive. The life of all fishes seems to be one of hide and seek.

One of the most toothsome of Australian fresh-water fishes is, undoubtedly, the golden perch. It is common in all rivers and water-holes and swamps that are intersected by deep water. It is a very beautiful fish; the general colour of the back is a bright green, the sides are a rich golden yellow, the head, when the fish is in season, has all the colours of the rainbow. In some specimens, the belly is white, in others it is red. The pupil of the eye is purple surrounded by a white ring. These colours only appear in the adult fish; the young are far more sombre in colour. For stocking ponds these fish, being natives, are equal if not superior to any that could be imported. The flesh is white, delicate, and of good flavour, and in weight they run to about 7 lb.

Of the silver bream, sometimes called the silver perch (*Therapon Richardsoni*), the Rev. J. E. Tenison-Woods says "This is the perfection of fresh-water fishes, extremely rich and delicate in flavour." In weight they run to about 5 lb. or 6 lb. They prefer running water in which to dwell. In the interior during dry seasons when the rivers and creeks become chains of ponds and billabongs these fish are found to be as healthy and in as good condition as the golden perch, and it is highly probable they would submit to pond culture equally with their golden brethren. They are found in all the tributaries of the Murray.

The perch of the old colonists is of a silver grey colour, darker on the back, and turning to white on the belly. This, the common perch, is to be met with at the head and in the tributaries of all the rivers in the Eastern Slope of the Great Dividing Range. In the Western Slope, in the watershed of the River Murray, is a fish very similar, known to scientists as Macquarie's perch. Both of these are catalogued among edible fishes, and afford excellent sport for fishermen who dwell in proximity to these rivers. They give great sport. When hooked they fight for freedom and dispute every inch over which they are hauled. They love deep holes where it is quiet and shady. In some of our fresh water creeks that are covered over with aquatic weeds, with here and there an opening, or, as it is sometimes termed, a breathing hole—in these holes the largest perch are to be found, and a black cricket dropped into such a place is sure to attract the largest fish in it. These common perch are not particular as to the waters they frequent. I have caught them in the salt water estuary of the

A SECTION OF A FISH-POND, SHOWING WATER-PLANTS AND FISH SUITABLE FOR CULTURE IN TANKS AND DAMS IN NEW SOUTH WALES.

Clarence River as well as in the brackish and fresh water higher up towards the head. I have caught them from 4 lb. to 6 lb. After a flood they are to be met with in the shallow waters, where they have been left behind, and there they remain till the waters dry up. From such places enough small fish could be taken to stock any sheet of water required.

Mullet.

In the waterholes in and about Marrickville (Sydney) which have been made by the removal of clay for brick-making there are large numbers of fresh water mullet that have been carried there when the flats have been flooded. In these holes the fish thrive and multiply. Speaking of these fish J. Douglas Ogilby says:—"Few, if any, fishes can be more easily domesticated than those belonging to the *Mugilidæ* (mullet family). . . . Their hardiness, their adaptability to the various conditions of life, their indifference to the density of the element which they inhabit, the fact which has been proved that they breed and thrive equally well in enclosed *fresh* water ponds as under normal conditions, the ease with which they may be brought to perfection at a minimum of cost, since no artificial method of supplying food would be required, all point to our grey mullet as the pioneer of a fishing industry." If all this be true, there is surely no better fish for the purpose for which I write than this same grey mullet. If such fishes as the varieties of perches and mullet can be had with so little trouble why advocate the introduction of foreign fishes into our waters?

The Gourami is a foreigner, and is said to be one of the best flavoured fresh water in the East Indian Archipelago. It is a native of Java, Borneo, &c. It has been successfully carried to The Mauritius and to South America. Therefore there would not be much trouble to introduce it into New South Wales. The family of fish to which the Gourami belongs appears to have been designed by nature for the purpose of being transported from country to country.

"They have a kind of supernumerary gill in a cavity to itself which enables the fish to live for some time out of water. In the accessory bronchial cavity there is lodged a laminated organ which evidently has the function of assisting in the oxygenisation of the blood. This accounts for the ease with which some can be acclimatised and transferred from pond to pond." The Gourami, when full grown, weighs from 8 lb. to 10 lb.

REFERENCE TO PLATE.

1. Umbrella Grass (*Cyperus alternifolia*).
2. Water Plaintain (*Alisma plantago*).
3. Arrow-head (*Sagittaria*).
4. Water Starwort.
5. Canal-weed.
6. *Vallisneria spiralis* (female plant).
7. Millefoil.
8. Water Lily (*Nymphæa alba*).
9. Water Lily (*N. odorata*).
10. Anacharis.
11. Pond-weed and Pond-snail.
12. Bullrush (Bobibobi).
13. Australian Perch.
14. Murray Cod.
15. Grey Mullet.
16. Australian Gudgeon.
17. Fresh-water Mussels

Pig Breeders in Conference.

A Discussion on Fodder Crops.

The following extracts are from the report in the *Farm and Ranch* of a conference of Texan pig-breeders. The points touched upon have so much in common with the system of paddock feeding pigs in New South Wales that it is thought the facts elicited in the discussion may prove instructive to those engaged in the pig industry in the Eastern Division of this State.

Colonel Stokes, of McKinney, gave his experience in pasturing pigs by saying he had to furnish the land and the other fellow furnished the pigs and did the work. He advised the man on his place to use just as "large a proportion of wind and branch water as could be put into the pigs and make them weigh heavy," and his partner succeeded in doing this because the pork was raised for less than 2 cents per lb. Pasture must be used with the pig, regardless of cheap corn. When corn falls to 20 cents a bushel, he urged feeding all the pasture possible to make a growthy pig. This is what he called his "wind and branch water treatment." He used oats, barley, rye, and lucerne. The more of it the less trouble. "We can raise pigs on this feed alone, and fatten or harden them on corn, but I believe in grazing them and at the same time feeding one or two ears of corn (maize) daily, and then finish with all corn."

Question: What is the cost of raising pork at your place?

Answer: One and three-quarter cents a pound (⅞d.), all expenses covered, including labour, taxes, and rent of land.

Mr. Henry declared that the value of pasture for pigs could not be overestimated. He spent £110 one season fencing in pasture for eight brood sows and got back the cost of the pigs and the fencing, with 20 per cent. profit on the investment, the first season. He lets the pigs come the 1st of October (that would be in, say, April in New South Wales) and the 1st of April (October in New South Wales) and runs them at both seasons on wheat as first pasture. In his opinion, wheat at the right stage is better for pigs than lucerne. The pigs prefer it to lucerne on his place, though he uses both. In this way he raises two litters of pigs each year, averaging last year 208 lb. each. The secret of success in pig-raising is fencing for the pigs. He estimates that with this system of pasturage a 200-lb. pig can be raised and fattened on pasture and 6 bushels of corn. The wheat pasture does not cost anything, because a grain crop can be secured from it. When he remarked that lucerne was the king of all plants, and that he appreciated it fully, Secretary Simmons spoke up and declared that Mrs. Simmons prepared tea for his use from this king of forage crops. Some one asserted that pigs gathered maize cheaper than it could be

pulled and fed to them, and thought it necessary to give them the run of the corn-fields, but this suggestion did not meet with general approval.

Question: How do you like rape as a feed for sows and young pigs?

Mr. Edmonson answered this by request of the chair, saying that he had had three years' experience with the crop, and the only objection found to it was its tendency to loosen the bowels as all green feed would. "I like it better and better every year," he said finally, "and pigs eat it freely in winter, when there is nothing green to be had. They even dig up the roots and eat them."

Question: When do you sow rape?

Answer: At the same time as I do turnips, and in drills. It stands hot weather well.

Col. Coffee then discussed the question by saying: "The pig cannot have too much pasture. The pig-grower must quit depending on corn. We came here to swap experiences, and I am going to tell you how I manage my pigs. I have lucerne and wheat for pasture because we are in the pig business for money. Last year I had a patch of 8 acres of sorghum, and I cut and fed it when it was mature and sweet, because I find that there is little substance in sorghum when it is so young and tender. I want the saccharine in my cane before I cut it. Wheat and lucerne were knee high last spring on my place, and the hogs liked the lucerne much better than they did the wheat. You could hardly drive them off the lucerne on to the wheat. I had 120 pigs in this field. The greater variety for pigs the better. I believe in variety on the farm. Plant lucerne, plant pigs, plant sugar beets. A pig is just like a man. He needs variety, and in securing this variety we must not overlook the pie melon. The pie melon is almost as good for a man as it is for a pig. If you people here lived north of Mason and Dixon's line and could grow pie melons that covered the earth with their fruit, you would grow them for the people to eat."

The pie melon does not do so badly in this State. In another part of this issue, Mr. Peacock, of Bathurst Farm, shows a patch, which returned 57 tons 10 cwt. of melons this season.

A Member: I believe in variety for the pig, but don't want too many crops. I love pig so well that my wife says I squeal if she wants 50 dollars, and that I even grunt in my sleep. I planted cotton for ten years, and I was in debt until I gave it up. I do not owe any man a cent. now, and I believe the pig got me out of trouble, and I am going to stay by him and stay out of debt.

Secretary Simmons: Whether or not pastures are over-estimated depends on the man. I do not think that any man can raise a pig on pastures alone. I do not believe that pastures alone make a pig of good weight. Time is too short on which to raise a pig to depend on pastures alone. From what I can see some of these lucerne people are a little off in their feed facts. It takes maize along with pasture to make 200-lb. pigs from spring litters of pigs during the season.

Question: How often do you feed your pigs?

Answer: At least twice a day, and give them maize or some grain each time.

Mr. Hudson, of Ellis county, reminded the breeders that they should not forget to grow mangel wurzels for their pigs. The farmers of his neighbourhood had grown 20 tons per acre during the past fall. They make good cow feed, and they sold on the market for nearly £1 per ton. He recommended that they sow the seed in spring, and at the rate of 4 or 5 lb. per acre, using Planet Jr., or some other machine, for putting the seed in. The plants should be left 1 foot apart in drills, rows 2½ feet wide.

Pig and Fruit-growing.

Mr. Jarrett, of Dialville, in East Texas, representing a combination of fruit and pig-growing interests, stated the situation as he had found it among the more progressive fruit-growers of his section. He said, "We are growing as fine peaches and tomatoes as anyone, and find the pig profitable in connection with them. We have a great pig country. Peas sown broad-cast make large crops, peanuts, sorghum, and mast (acorns), together with spring and branch water of the best quality, give us many natural advantages. Many of our people are interested in pig-raising, and we are growing them on a small scale. Several from East Texas are here seeking information; but I will give you my experience. I sowed 2½ acres to rape last fall. The October freeze killed it. I had not grazed it, and it was 6 inches high, and seemed to be doing well until it was killed. It seems totally dead. I think dry weather, with the frost following, killed it. We have a fine sweet potato country, and I fattened fifty head of pigs last season on sweet potatoes. The cow-peas cost very little. Sow the cow-peas in June, using the speckled kind, because they do not climb on the orchard trees. In cultivating the peas, the orchard is cultivated. We must cultivate the orchard anyhow. I had 50 acres of peas, and turned the pigs in on them in August; but they could not eat all of them. I saved 8,000 or 10,000 lb. of peas that were picked at a cost of 40 cents per 100 lb. The pigs were turned from the peas into the peanuts, giving a succession of feeds. I find it easy to get the growth; but I want to know the very best combination of feeds to mix with peanuts and cow-peas for fattening pigs."

This question appears to have been overlooked, or the reply has been missed by the reporter. As applied to the conditions of New South Wales, pea-nuts are a cheap, easily-grown food in many districts. It is said, however, that they have a tendency to produce oily pork and soft bacon. Cow-peas would probably balance them to a certain extent, but, in paddock feeding, the cow-peas and the pea-nuts would scarcely be grown on the same area, and the pigs might therefore not eat due proportions of each, as they will when cow-peas are sown with maize. If it is desired to use pea-nuts and cow-peas with stye pigs, it would be necessary to add grain, say one part wheat or barley, and two parts maize, to produce the best results, or artichokes or sweet potatoes, if available early enough, might be used with them.

Weeds of New South Wales.

By J. H. MAIDEN,
Government Botanist, and Director of the Botanic Gardens, Sydney.

The Buffalo Burr (*Solanum rostratum*, Dunal).

(Previous references: March, 1904, p. 246; April, p. 316.)

Botanical Name.—*Solanum*, the Latin name for "a herb called Nightshade or Banewort," *Solanum* being the botanical name for the plants commonly known as "Nightshade" in Britain; *rostratum*, Latin, beaked, in allusion to the beak-like appearance of one of the stamens, as shown in the drawing.

Vernacular Name.—"Buffalo Burr." Called "Burr"* from the fruit, which was "doubtless spread to some extent by the buffaloes, as it has been found along the buffalo wallows." "Beaked Horse-nettle" is another name. The prickly Solanums are often called "Horse nettles" in the United States, on the *lucus a non lucendo* principle; the meaning of the adjective "beaked" has already been given. "Sand Burr," because it prefers sandy land; it is also called "Rocky Mountain Sand Burr." Sometimes called "Spiny Nightshade."

Botanical Description.—Annual, densely stellate-pubescent witn 5–8-rayed hairs, usually copiously armed with yellow subulate prickles; stem erect, branched, 1 to 2½ feet high; leaves ovate or oval in outline, irregularly pinnately 5–7-lobed or 1–2-pinnatified, 2–5 inches long, petioled, the lobes mostly oblong, obtuse; flowers racemose, yellow, about 1 inch broad; racemes lateral, pedicels stout, 3–6 lines long, erect both in flower and fruit; calyx densely prickly, surrounding and wholly enclosing the berry, the prickles becoming as long as the fruit, or longer; calyx lobes lanceolate, acuminate; corolla about 1 inch broad, slightly irregular, its lobes ovate, acute; stamens and style declined, the lowest stamen longer with an incurved beak; fruit, including its prickles, 1 inch in diameter, or more.

Fodder or other Uses.—I have vainly searched for any use or redeeming feature that I can ascribe to this bad weed.

How to get rid of it.—The burr or fruit is a spiny ball, full of black seed. It becomes attached to passing animals, hence its liability to rapidly spread. "It is often blown about as a tumble-weed in the prairie region of the United States."

It is an annual, and should be pulled up or mown down before it matures its seeds. If, therefore, people recognised it and pulled it up before seeding, it could be destroyed in one year. It is stated to be

* "Bur" is the American spelling.

"expected to be an impurity in West American Alfalfa (lucerne) and clover seed." It is a matter of common knowledge that rubbish-heaps in the vicinity of townships are allowed to propagate weeds unchecked, it being simply nobody's business to eradicate them. One of the Farmers' Bulletins of the United States Department of Agriculture, speaking of this as the way in which the Buffalo Burr has often been spread, says: "Similar instances might be multiplied; in fact, probably the majority of the cities and towns of this country are harbouring noxious weeds which should be destroyed in simple justice to the farming communities which aid most directly in supporting the prosperity of these towns." These observations can with justice be applied to New South Wales also. One Bulletin says it has been transported in packing materials. In the United States it is looked upon as likely to occur "wherever western grain is handled," and I am afraid we may trace its advent here to dirty seed-wheat or dirty chaff. It is recognised as a bad weed in the United States, and a number of experiment stations have published warnings concerning it.

Where found.—Native of the United States of America, originally growing on the western plains, close to the mountains, from Mexico northward. The Buffalo Burr has been working eastward until it is now found in many States east of the Mississippi River, and has even crossed the ocean, threatening to become a troublesome weed in Germany.

Only recently I announced this as a new Australian weed making its appearance at Boggabri in this State. Shortly afterwards it made its appearance at Yass.

REFERENCE TO PLATE.

A. Imperfectly expanded flower, showing the beaked stamen to which the plant owes its specific name. One of the petals has also a clawed or beaked appearance.

B and C. Two seeds, greatly enlarged, showing their irregular shape and tuberculate surface.

D. Flower, showing the cluster of prickles under the calyx.

Is the Tree Tobacco Poisonous?

"*Wild Tobacco,*" "*Tree Tobacco.*" (Nicotiana glauca, *Grah.*)

This is a plant abundantly acclimatized in the hot western districts, and found as far east as Scone and other places. It forms a tall slender shrub or small tree. Notes will be found on it in the *Gazette*

SOLANUM ROSTRATUM, Dunal.

for January, 1897, p. 15, and for April, 1901, p. 479. In the former reference Professor MacOwan, of the Cape (where the plant is a native), was in some doubt as to whether it is poisonous to ostriches. In a recent number of the *Cape Agricultural Journal*, October, 1903, p. 397, Mr. D. Hutcheon, the Colonial Veterinary Surgeon, states specifically that the plant is poisonous to cattle, sheep, and ostriches. As the plant is so abundant in this State, and I have no reports of its poisonous nature here, I reproduced Mr. Hutcheon's report. I would ask correspondents to keep the plant under observation, and report any suspected cases of poisoning.

It would appear that a very small quantity is required to produce its poisonous effects.

Mr. S. Hobson says:—"I have seen sixty young ostriches die in a few hours from eating the seeds of the wild tobacco that had got mixed with their food. One seed is certain death to a chick up to a month old. I have seen big ostriches die from eating the chips and pieces of bark, where the men have been cutting spars. It seems deadly to the ostriches in any form, but, strange to say, I have seen a flock of sheep passing through the district eat it with evident relish and suffer no ill effects."

Mr. A. H. Schmidt, of Bloemfontein, says:—"I had a young tobacco tree growing on my dam wall. A span of oxen got on to the wall one day, and although they were driven off as soon as they were observed, some had already eaten a few of the leaves, with the result that within seven hours one died, and before night four more were dead." He says, further, "I know of two transport riders who lost in the town, here, twenty-one out of twenty-eight oxen. The oxen were hungry and fed on the wild tobacco tree." He adds, "I am of opinion that this plant is only poisonous at a certain time of the year."

This plant is very fatal to ostriches of all ages, both in the green and dry condition, but they are more liable to eat it after it is cut.

Symptoms.—"There is first spasmodic contraction of the voluntary muscles, followed by stupor; the birds sit down and throw their heads about; finally the neck is doubled right back and the head laid on the body, death being due to coma."

Treatment.—"Castor-oil is recommended to be given at once by the majority of experienced ostrich farmers. Some are of opinion that almost any oil would have a beneficial effect. R. Gavin, in addition to giving castor-oil, recommends that the birds be placed in cold water."

James H. Biggs says:—"Wild tobacco does not appear to be poisonous to other animals, which seldom eat it. As a youngster I have many times sucked the juice from the blossoms, which is sweet. Baboons eat it with evident relish, and it has no apparent bad effect on them." He has every confidence in the efficacy of oil if given early. He used salad-oil.

Two Garden Plants Suspected of being Poisonous to Stock.

The following notes are based on a paper by the Colonial Veterinary Surgeon, Mr. D. Hutcheon, in the *Cape Agricultural Journal* of October, 1903:—

1. *The Oleander* (*Nerium Oleander,* Linn.)—The opinion seems to be that Oleander leaves undoubtedly poison stock. The case of the recent death of a valuable Government Clydesdale stallion is quoted. Professor MacOwan gives the following note:—

"*Nerium Oleander,* L., well-known in gardens by its specific name only, is actually poisonous, and has been the subject of research by many pharmacologists. The active principle in the leaves resembles that of *Digitalis,* the foxglove, and reacts directly upon the heart, stopping its action at the moment of expansion. As little as ·25 of a milligramme is sufficient to paralyse the movement of the heart in a lively frog. In the *Gardeners' Chronicle* for 28 May, 1881, p. 696, there is quoted a case of a fine healthy mare being poisoned and dying within twenty-four hours after eating a single tuft of the leaves. An instance is recorded of a party of twelve soldiers, who cut from an Oleander tree skewers on which to roast their ration of meat, and the poisonous principle transferred to the food proved fatal to seven out of the number. The Oleander is a native of the whole Mediterranean region, and is one of the most widely cultivated ornamental shrubs throughout the temperate zone. *Nerium odorum,* L., the 'Kunnar' of India, possesses similar poisonous properties, the bark of the root being especially virulent. It is the commonest rat-poison used in the Presidency of Bombay, and has often been brought into notice as the drug employed in cases of suicide."

2. *Cestrum nocturnum,* Linn.—This is a South American tall shrub, common in gardens. It has greenish-yellow flowers, and it fills the atmosphere at night with its heavy perfume, hence its specific name. It is common in Sydney gardens. A report is given of a case of suspected poisoning of a Jersey cow by this plant. The cow ate the trimmings of a hedge which had been thrown into the field where she was grazing.

In the *Gazette* for October, 1895, p. 676, I reported a suspected case of cattle-poisoning near Sydney through eating the leaves of the orange-flowered *Cestrum* (*C. aurantiacum,* Lindl.)

All the *Cestrums* should, in my opinion, be put on the suspected list, and domestic animals should be kept from them. I would point out that as a matter of common observation stock will often not touch a green plant, while leaves of the same tree which have been cut or broken off and allowed to wilt are acceptable to them. Whether a process of fermentation goes on in the fading leaf which renders it more palatable, I do not know, nor whether certain poisonous principles are formed in increased quantity in the leaf as it withers. It is better to be on the safe side with *Cestrum.*

Canadian and British Dairy Legislation.

M. A. O'CALLAGHAN.

IN last issue I referred to the measures that are being taken in Canada and Great Britain to protect the interests of the dairy producers and manufacturers and shippers of butter. I now reproduce from the Canadian Butter Act and British Butter Bill some of the clauses which are of special importance to the dairy producers in this State, seeing that until they have similar legislation here our dairy farmers and butter manufacturers remain at the disadvantage of being exposed to practices which have the effect of injuring the reputation of their products and restricting the expansion of trade abroad.

Canadian Dairy Legislation (extracted from "The Butter Act, 1903").

1. This Act may be cited as "The Butter Act, 1903."

2. In this Act, unless the context otherwise requires—(*a*) "Creamery" means a place where the milk or cream of not less than fifty cows is manufactured into butter ; (*b*) "Dairy" means a place where the milk or cream of less than fifty cows is manufactured into butter in a building equipped with proper appliances ; (*c*) "Butter" means the food product commonly known as butter, which is manufactured exclusively from milk or cream or both, with or without the addition of colouring matter, common salt, or other harmless preservative ; (*d*) "Creamery Butter" means butter which is manufactured in a creamery ; (*e*) "Dairy Butter" means butter which is manufactured in a dairy ; (*f*) "Renovated Butter" or "Process Butter" means any butter which has been melted, clarified or refined, and made to resemble butter.

3. No person shall manufacture or import into Canada, or offer, sell, or have in his possession for sale any butter containing over 16 per cent. of water.

4. No person shall mix with butter any acid, alkali, chemical, or other substance whatever, which is introduced or used for the purpose or with the effect of causing the butter to absorb water or any part of milk or cream.

5. No person shall manufacture, import into Canada, or offer, sell, or have in his possession for sale, any oleomargarine, butterine, or other substitute for butter, manufactured wholly or in part from from any fat other than that of milk or cream.

6. No person shall manufacture, import into Canada, or offer, sell, expose, or have in his possession for sale, any renovated butter, process butter, or butter which has been treated in the manner described in section 4.

7. No person shall brand or mark the word "creamery," or any combination of words which includes the word "creamery" upon any box, package, or wrapper containing butter, unless the butter contained in the box, package, or wrapper consists wholly of creamery butter manufactured at one place.

8. No person shall sell or offer, expose, or have in his possession for sale, any butter contained in any box, package, or wrapper upon which the word "creamery," or any combination of words which includes the word "creamery," is branded or marked, unless the butter contained in the box, package, or wrapper consists wholly of creamery butter manufactured at one place.

9. Nothing contained in sections 7 and 8 of this Act shall apply to butter in rolls, prints, or packages of less than twenty-five pounds in weight, not intended for export, provided the said butter is manufactured in a building equipped with the appliances used in creameries.

10. Every person who, by himself or through the agency of any other person, violates any of the provisions of this Act, shall, for each offence, upon summary conviction, be liable to a fine not exceeding fifty dollars, and not less than ten dollars, if such offence is a violation of any of the provisions of sections 3, 7, or 8, and not exceeding four hundred dollars, and not less than two hundred dollars, if such offence is a violation of any of the provisions of sections 4, 5, or 6, together with the costs of prosecution; and, in default of payment of such fine and costs, shall be liable to imprisonment, with or without hard labour, for a term not exceeding three months, unless such fine and the costs of enforcing it are sooner paid.

11. Any person charged with the enforcement of this Act may enter any premises to make examination of stock or packages and the marking thereof, whether such stock or packages are on the premises of the manufacturer or owner, or on other premises, or in the possession of a railway or steamship company; and any person who obstructs or refuses to permit the making of any such examination shall, upon summary conviction, be liable to a penalty not exceeding five hundred dollars, and not less than twenty-five dollars, together with the cost of prosecution, and, in default of payment of such penalty and costs, shall be liable to imprisonment, with or without hard labour, for a term not exceeding six months, unless the said penalty and costs of enforcing it are sooner paid.

The Act thus prohibits the importation and manufactnre of any butter substitutes, whether milk-blended butter or margarine. It also prevents the manufacture of butter containing more than 16 per cent. of water. The purity of Canadian butter should, indeed, be now assured. The Act also guards against the misuse of the word "creamery."

Extracted from the "Sale of Butter Bill" now before the British Parliament :—

1.—(1) It shall be unlawful to manufacture, sell, or expose for sale any butter containing more than 16 per cent. of water, or any butter to which any substance has been added whereby the amount of water in the butter is increased, and if any person manufactures, sells, or exposes for sale, any butter in contravention of this section, he shall be liable on summary conviction for the first offence to a fine not exceeding twenty pounds, and for the second offence to a fine not exceeding fifty pounds, and for the third or any subsequent offence to a fine not exceeding one hundred pounds.

(2) Butter the sale of which is prohibited under this section shall be included amongst the articles on the importation of which penalties are imposed by section 1 of the "Sale of Food and Drugs Act, 1899," and that section shall apply accordingly.

2.—(1) An officer of the Board of Agriculture and Fisheries shall have power to enter at all reasonable times any premises in Great Britain in which that officer has reasonable grounds for supposing that butter is made, treated, or manipulated in contravention of this Act, and to inspect any process therein and to take samples for analysis.

(2) The like powers shall be exercised in Ireland by an officer of the Department of Agriculture and Technical Instruction for Ireland.

Dairy Cattle Records.

M. A. O'CALLAGHAN.

SOME interesting figures regarding the milk and butter records of cattle of various breeds are given in Bulletin 102 of the Wisconsin Agricultural Experiment Station.

The records cover a period of four and a half years. The breeds represented were Guernsey, Jersey, Holstein, Shorthorn, and Red Polled.

The highest average yield for a year was made by a Jersey cow, she having given 7,621 lb. of milk and 474 lb. of butter-fat.

The average butter-fat yields are as follows :—

		lb. per annum.
Red Polled (one cow)	...	461·81 butter-fat.
Holstein (five cows)...	...	351·62 ,,
Guernsey (nine cows)	...	319·35 ,,
Jersey (twelve cows)	...	301·13 ,,
Shorthorn (eleven cows)	...	281·73 ,,

The average net profit returned by cows of these breeds decreased in the same order from £11 7s. (Red Polled) to £7 4s. (Shorthorn).

Regarding the food of these cows, the report says :—"The general plan of feeding adopted has been the one which we consider the fundamental requirement in the successful management of a modern dairy, viz., to feed each cow on as much rough feed as she will eat up clean, and, in addition, such amounts of the available common concentrated feeds as she will give returns for in production of milk without any material change in live weight, the character and amounts of grain feed being, therefore, adjusted according to the peculiar characteristics of each cow. Fed according to this system, our cows have made very creditable returns in the production of milk and butter-fat during the period under investigation, viz., on the average for the thirty-eight cows and for four years 7,340 lb. of milk and 307 lb. of butter-fat, equivalent to 370 lb. of butter per head annually. Our studies of the data showing the production and feed consumption of the cows in our herd have led to a consideration of many points of interest and importance to dairymen."

The weakness in these figures from a breed test point of view is the great difference in the numbers of cows of each breed, varying from one Red Polled to twelve Jerseys.

The Red Polled is, in my opinion, a good bit above the average cow of that breed ; but in saying this, I do not mean to convey the opinion

that Red Polls are not good dairy cattle. Some of the finest looking young dairy cows I have lately seen are a bunch of cross-bred Red Polls by the Government imported Red Polled bull Dairyman.

The records put up by Lord Rothschild's Red Polled herd, however, speak out much more strongly for this useful breed than anything we can show down in this Antipodean world. Thirty-seven cows in the Irving Park herd during 1903 gave an average of 7,007 lb. per head. The highest yield was 10,387 lb., given in 336 days, by the 6-year old cow Peaceful.

A Guernsey Record.

When it comes to individual records, however, the Guernsey cow, Charmante of the Gron, No. 14,442, knocks out all other authentic yields. She calved in October, 1902, and began her record on 11th October. In twelve months she yielded 676·46 lb. butter-fat, equal to 789 lb. of butter. The testing and weighing of the milk was carefully supervised by the New Jersey Experiment Station. This remarkable cow was born in England; but she was sired in Guernsey, after which her dam was imported into England. In 1901 Charmante of the Gron was imported into the United States. During the time the record was being made she consumed 172·6 lb. bran, 833 lb. gluten, 160 lb. cotton seed meal, 58 lb. maize meal, 58 lb. middlings. This works out at 8 lb. per day. She also was given in summer, besides pasture, some oats and peas, clover, lucerne, and corn, and in winter she was fed ensilage (maize), mangels, and mixed hay as bulk fodder.

Our Dairy Industry.

The following remarks, taken from a recent report of one of my field assistants, illustrate briefly the condition as well as the curse of our dairying industry.

Writing of three factories in one district, he says:—

No. 1 factory is getting a considerable amount of inferior cream. All the cream is graded, and the inferior cream is churned by itself, *but not booked as second class nor paid for as such.*

No. 2 factory grades all cream pretty strictly and pays a lower price for inferior cream.

No. 3 factory does not grade the cream received, but mixes all together and makes but one quality butter.

Out of the three factories there is thus but one worked on right lines. The two factories that pay the same price for inferior cream as for good cream are doing an injustice to the good suppliers, and are injuring the industry by encouraging, through a high price, the producers of inferior cream to continue their present methods.

It should be made illegal to thus rob the good producer and give the plunder to the bad one.

Report of the Commercial Agent on New South Wales Butters in London.

In last issue there appeared a special report by Mr. C. C. Lance, Commercial Agent for New South Wales, on the condition on arrival in London of butters shipped from this State.

Hereunder Mr. Lance furnishes a report on twenty-two brands of butter shipped per R.M.S. *Moldavia*:—

BUTTER REPORT, 4TH MARCH, 1904.

Butter ex R.M.S. *Moldavia*. Arrived London 19th March, 1904.

No.	Packing.	Flavour.	Make.	Colour.	Salting.	Condition.
1	Good..	Irregular, but mostly good.	Good texture ..	Correct..	Correct ..	
2	Correct	Irregular, common ..	Fair texture, but mottled.	,, ..	,, ..	
3	,, ...	Common	Good texture ..	Rather high.	,, ..	
4	Not good, top not rolled.	Tallowy, affected by heat	Fair texture, but too much moisture.	Correct..	,, ..	Heated.
5	Good..	Irregular, some quite good, other common.	Good texture ..	,, ..	,, ..	No heating noticed th week.
6	,, ...	Common	,, ..	,, ..	,, ..	
7	,, ...	Common, tending to rancidity on outside.	,, ..	,, ..	,, ..	
8	,, ...	Tallowy and common, affected by heat.	,, ..	,, ..	,, ..	Heated.
9	,, ...	Common	,, ..	,, ..	,, ..	
10	,, ...	Good	,, ..	,, ..	,, ..	
11	,, ...	Common	Fair texture ..	,, ..	,, ..	
12	,, ...	Common, not up to usual standard.	Good texture ..	,, ..	,, ..	
13	Fair	Improved, but still common.	Fair texture, but too much moisture.	,, ..	Rather too salt.	
14	Good, but paper too thin.	Good, clean flavour ..	Good texture ..	,, ..	Correct.	
15	Fair	Very fair	Good texture, but mottled and rather moist.	,, ..	,,	
16	Fair, but paper too thin.	Common and tallowy, affected by heat.	Not good texture. Mottled.	,, ..	,, ..	Heated.
17	Well got up ..	Good, but behind usual standard.	Good texture ..	,, ..	,,	
18	Good..	Common and tallowy ..	Fair texture, but mottled.	,, ..	,, ..	Heated.
19	,, ...	Common and slightly fishy.	Good texture ..	,, ..	,,	
20	,, ...	Good and even, but not quite so choice as usual.	,, ..	,, ..	,,	
21	Correct	Fishy	,, ..	,, ..	,,	
22	Bad; not rolled on top.	Common, and tending to rancidity.	Bad texture. Mottled.	,, ..	,,	

The butters generally show signs of having been affected by hot weather and insufficient care of cream.

CHAS. C. LANCE,
Commercial Agent.

London, 25th March, 1904.

Speaking of our New South Wales butters ex *Moldavia* generally, Mr. Lance says they show marked evidence of having been made under conditions of insufficient refrigeration, and want of the proper protection of cream from the effects of hot weather before delivery. Heating during transit to cold stores is also evident in several cases.

Mr. Lance adds: "I should judge the average intrinsic value of the butters this week as 2s. per cwt. below what they were two and three weeks ago. But as evidence of what can be done, I would again mention the 'Unara' butter made in such a hot district as Byron Bay, and which, though not as choice this week as it generally has been, is still very good, sweet, and even. When it is remembered that this is the largest line of butter arriving, and amounting to 1,200 to 1,500 boxes weekly, this result will be deemed worthy of special remark."

For the purpose of illustrating this point, Mr. Lance took a photograph of an average box of butter which arrived in good condition, and a photograph of some boxes which had not been made under the proper conditions and with sufficient care to withstand deterioration even in transit to the port of shipment. Where in one case the carefully made and handled butter opens up with the brand perfectly clear and legible, in the other there is disclosed upon removing the lid a smeary mass. In cases like the latter, not only is the sale and reputation of the butter prejudiced by the appearance, but the quality of the article is also affected, and in a much lesser degree this would happen even in cases where the rise of temperature was not evident.

In explanation of the terms used in describing the butters reported upon, Mr. Lance states: "When I speak of a brand as heated, I mean that it has this appearance in a more or less marked degree."

In Canada the Chief of the Dominion Government Dairy Service has been suggesting improvements to makers of butter for export. The chief complaint is that of irregularity of quality, and the cause of this defect is held to be due to the fact that the butter is not kept cold enough at the creameries, is exposed to heat unnecessarily in transit to Montreal, and is not frozen properly at that point before being placed in the cold storage chambers of the steamers conveying it to this country. The remedy is to be found in better supervision at the creameries, on the railway, and at the port of shipment.

The Duration of the Effect of Green Manures.

M. A. Peterman, in the Belgium *Bulletin of Agriculture*, gives an account of experiments with a number of crops grown on soil which had been in grass, the sod being turned under, and on soil which had been under clean culture. The results indicated that the effect of green manuring is quite noticeable on early potatoes, less marked on late potatoes, still less marked the second year, and disappears the third.

Farming for Profit.

W. H. CLARKE.

In embarking in agricultural pursuits, many people, young and middle-aged, set out with the idea that, unless their farming operations will return wages in cash, farming is a failure. This is only natural, and especially so in the case of a man who has been used to the regular, or comparatively regular, weekly or monthly cash income of a tradesman or clerk. All the same, it is, as will generally be found, not only in this State, but in any other country, an erroneous view. The first consideration of the man of small means who settles on the land should be to make a living on it. That is to say, he should use every effort, before he goes in for market crops, to produce, to as great an extent as possible, the food requirements of his family; and, when he has settled, or partially settled, this important problem of living on the land, the question of monetary returns will settle itself.

In numerous districts there are selectors whose sole aim is to get in some crop that will return cash, and they concentrate their energies upon that point to the neglect of everything else. The consequence often is that, after months, and, perhaps, almost a year's incessant toil, and hard and uncomfortable living, the selector has for market, say, a crop of maize—possibly 400 bushels off the 10 acres he has almost burst himself to clear, sow, cultivate, harvest, bag and market. It netts him, say, 2s. a bushel, which would be as good as ever he could hope for, and that makes £40. £40 cash is, at least, something real and tangible; but at what actual cost has that cash return been secured? He may have had to buy the bulk of his vegetables, fruit, butter, milk, bacon, horse-feed, poultry, eggs, and all sorts of things for the house, or go without anything but the barest necessaries of bread and meat, tea and sugar, and let his horse almost die of starvation. If, on the other hand, he had spared himself the enormous effort—and that is, certainly, a mild term for it—of preparing the 10 acres for maize, and spent the time in getting half the area ready for potatoes, vegetables, fruit trees, a little plot of melons, strawberries, tomatoes, and passion vines—to take the place of fruit until trees and vines bear—with patches of pumpkins, sweet potatoes, sorghum, artichokes for stock fodder, with the balance of the 5 acres, say 3, for hoed-in maize, he would not have had to work so hard. The money spent on the horse and plough of the market-crop grower could, in the case of the man who aims first at living, be invested, as feed became available, in a cow, a sow, and some poultry. Then, by the end of the season, while the market-cropper with his £40 cash would still have to go on spending money for household necessaries, the "living" man, who, after making due provision for his live stock

and family requirements, may have only been able to send to market £6 or £7 worth of produce, has to his credit an increased asset in stock and a plentiful supply of home-grown food for his family and live stock.

By the end of the second season the market-man may have the crop from twice his original area to harvest, which, on the same good conditions as the first year, would be £80 cash return, less twelve months' expenses for the household necessaries which the other man does not have to purchase.

The "living" man, at the end of his second season, would have, on the same ratio, about twice the quantity of maize to market—£14. He may also have a dozen young pigs to sell; and, since their food has been entirely home-grown, the £12 he gets for them is nett cash. He may also, from the natural increase of his poultry beyond the domestic table and egg requirements, have a few pairs of fowls and some eggs to market, and possibly a calf coming on to sell for as much as her mother originally cost.

In the third year, at the same ratio, the "market" man would have cash returns from 30 acres, and under a continuance of the same good conditions would handle £120 cash.

The "living" man, at the same rate of progression, would have the cash from 9 acres maize, £36. From his pigs, now increased to four sows and a boar, he may have twenty-five young pigs to sell, another calf, and still more fowls and eggs, with perhaps the excess of vegetables, melons, &c., which can naturally be expected to arise from his greater experience and skill in raising them, and as a result of increasing supplies of manure. While the "market" man has still to make ready his 10 acres of extra land each year, the "living" man would, to increase his market area by 3 acres and his feed area by 1 acre per annum, have to do only 4 acres, and he would therefore have more time to devote to all his little side lines from which the principal comforts of his home and a good many odd pounds are derived.

Thus year by year things would go on—the "market" man striving all the time for cash and obtaining by expenditure of that cash most of the necessaries of his home, and the "living" man, with every hour of his time pleasantly occupied in a variety of pursuits, with his home well supplied with wholesome and, to many city people, luxurious food, gradually working up to the point where his market returns—which he treats as a side line—balance his expenditure for clothing, tea and sugar, &c., butcher's meat, ironmongery, tools, books, children's schooling, and other necessary items. When that point is attained, everything else is profit, and the well-developed little property, though small in cultivated acreage, is a better asset than many a man can show after twenty years' occupation of a well-salaried position in a city. This is, of course, assuming that everything works smoothly and that the cow does not break the fence and die of sorghum-poisoning, and the sow does not devour her litter and native cats do not decimate the poultry roosts, and gall worms or something levy too heavy toll on the crops. Disasters of this kind have all to be counted in, but to the man who depends for the bulk of necessities upon the diversified produce

of his own holding, the loss of a crop of potatoes, or even a series of calamities that involve in ruin half of his annual enterprise, does not fall with half the force that the loss of his crop by drought, flood, blight, or insect invasion will on the man who has only that single venture to depend upon.

In selecting a site for settlement it may appear at first thought to the man who has always lived in a town that it is unwise to get too far away from the metropolis. As a matter of fact, there are innumerable places within a day's dray journey of the city where the settler is more isolated than if he were to go a couple of hundred miles inland.

For the man who realises the possibilities of the systematic cultivation of good soil, and has the business instinct sufficiently developed to stimulate him to the manufacture of products that can be marketed in the most concentrated form, distance from market is not half the obstacle that sluggish soil and expensive clearing actually are. Some people in search of land for occupation very often go about with a sort of fixed idea that the true index to a soil's productiveness is the class of timber it is carrying in its virgin state. If they were to broaden this idea out so as to include the class of indigenous vegetation, they would be on very much safer lines. It seems to stand to reason that the soil where enormous blackbutts and other giants of the *Eucalyptus* family grow straight and dense must be good soil. So it generally is; but the man of small means, who must of necessity get some crops as soon as possible, has a good many things to take into consideration. In the first place, despite the fact that the great, tall trees indicate abundant rainfall and large stores of plant-food in the soil, with shelter from unfavourable winds, can he afford to clear such land? It may cost anything up to £20, or even £30, per acre. If one cannot afford to get the work done, but must depend upon his own labour, the chances are that it may be several years before there is sufficient land ready for cultivation, and sufficient area exposed to the sweetening influences of the sun, to enable the settler to get even the scantiest returns; on the other hand, where the selection is made in such country as is to be found along several of the main and branch railways—that is to say, in open forest country with only few trees to the acre,—the settler loses little time in preparatory operations, and is able, by reason of the greater degree of primitive sweetness of his soil, to get fair to good crops from the very jump.

Thus, to the man who cannot afford to undergo a prolonged unproductive period, as well as to the man whose muscles have not been trained to laborious bush-work, the country where grass is the principal indigenous crop is much to be preferred to land where the main natural growth is heavy hardwood timber or big brush.

It may be contended that the regularity and abundance of rainfall in the timbered districts, as compared with the light and irregular rainfall of the central districts, more than makes up for the initial expense of settlement. If one goes carefully into statistical returns, and computes how much is lost in (say) a stretch of ten years through excessive moisture and inopportune rainfalls with what is lost through droughts during the same period, one gets a regular facer. Moreover,

in very many instances in the humid districts, in spite of the actual richness of the soil, the crops will only go as far as you push them with manures. Manures are the proper thing to maintain the productiveness of an established farm, but to have to purchase them is a big handicap for a beginner.

While the man in a district with an average rainfall of 40 to 50 inches per annum can do little or nothing to escape the effects—direct and indirect—of too bounteous a rainfall, the cultivator of a well-chosen area in a district with a 24-inch rainfall can, by the adoption of a system of thorough cultivation, conserve soil-moisture sufficient even in very dry seasons to produce some crop, and in seasons of normal rainfall enjoy a range of crops almost as diversified as is possible in the moister districts. It is not meant that one can go into any part of the Central or North-western districts and take up any area. The site must be chosen with care and due regard to the class of work intended. The great advantage to the intending settler is that in these remote districts there are hundreds of thousands of acres of Crown lands lying as Nature made them ready for almost immediate cropping. As to the range of crops possible in such districts, visitors to agricultural shows are no doubt familiar with the marvellous collections of farm produce exhibited in the district competitions and by a few private exhibitors. These collections afford at least evidence of the capacity of districts with an average rainfall of about half that of the humid belts to produce nearly all the crops, fruit, and vegetables necessary for domestic purposes and staple crops for market.

In many parts of the Central Division a man can secure an area of the easily-cleared land which has been referred to, and while he makes it the guiding rule of his operations that, before he throws all his energies and all his resources into cropping for market, he will see to his own domestic and live-stock requirements, he can speedily develop into not only a grower of wheat for market, but he can have also the choice of several remunerative side lines to increase his cash returns and provide profitable and congenial employment for his family, as well as to fall back upon in adverse seasons. These side lines might be a few acres comprising two or three varieties of good carrying apples, or a plantation of apricots for drying, or of prunes or raisins, any of which could be cultivated thoroughly with the horses required for wheat-growing; or he could have a small flock of sheep to raise fat lambs, or a herd of pigs for bacon-curing. It would take time to get fairly well established and properly equipped, but the development would be on permanent lines, and the man who never takes another acre into cultivation, or never adds a single head to his live-stock until he sees his way quite clearly to thoroughly cultivate the one and provide sufficient food and to spare for the other, is not likely to suffer to the point of annihilation in even a severe drought. Some people who contemplate settling upon the land may feel that, without the assurance of a good rainfall, the enterprise is risky. It is really nothing of the kind. There is no royal road to making a living anywhere, be it in the city or on the land. The man who succeeds in the

city is the man who keeps his wits about him—never feels that he knows enough, is punctual, industrious, and systematic. In the office, at the bench, in the shop, a man, as a rule, has to be all these things as a matter of course. When he takes to farming and becomes his own "boss," he will find that it will not matter very much whether his good soil—which is a *sine qua non* for the man of small means—is in a wet district or a dry one; to succeed in either will call for the same persistent industry, the same keen judgment, and the same economy of time and labour as he, from habit, regarded as essential in the city. For the men of that temperament the drier district, in which for the majority of seasons things are so much more within one's control, and the climate is not so enervating, is much to be preferred.

Probably, the most successful and permanently prosperous farming communities in the world are the hundreds of thousands of holders of the 80-acre mixed farms of Utah and Colorado, in the United States. Irrigation is generally regarded as being responsible for that state of affairs; but while it is certainly the most important factor, it does not constitute the reason why these farmers are so well off socially and financially. The fact is, that when a man settles in Utah or Colorado, he settles in a country where Nature unaided does not assist him at all. He has to concentrate his energies in the systematic working of his farm, or perish. It is the same in Canada. The man who does not have everything, including himself, in perfect readiness to make the most of the four or five months, at most, in which crops can be grown, and supplies of food for man and beast stored away for the long winter, is apt to get snuffed clean out of existence before the next spring. It is very often due to this fact that what in other agricultural countries a farmer must do every year, or perish, the New South Wales settler may do if he likes, that the farms are neglected for the roads, the shearing shed, and all sorts of occupations that put a few pounds in one pocket, and take twice as much out of the other.

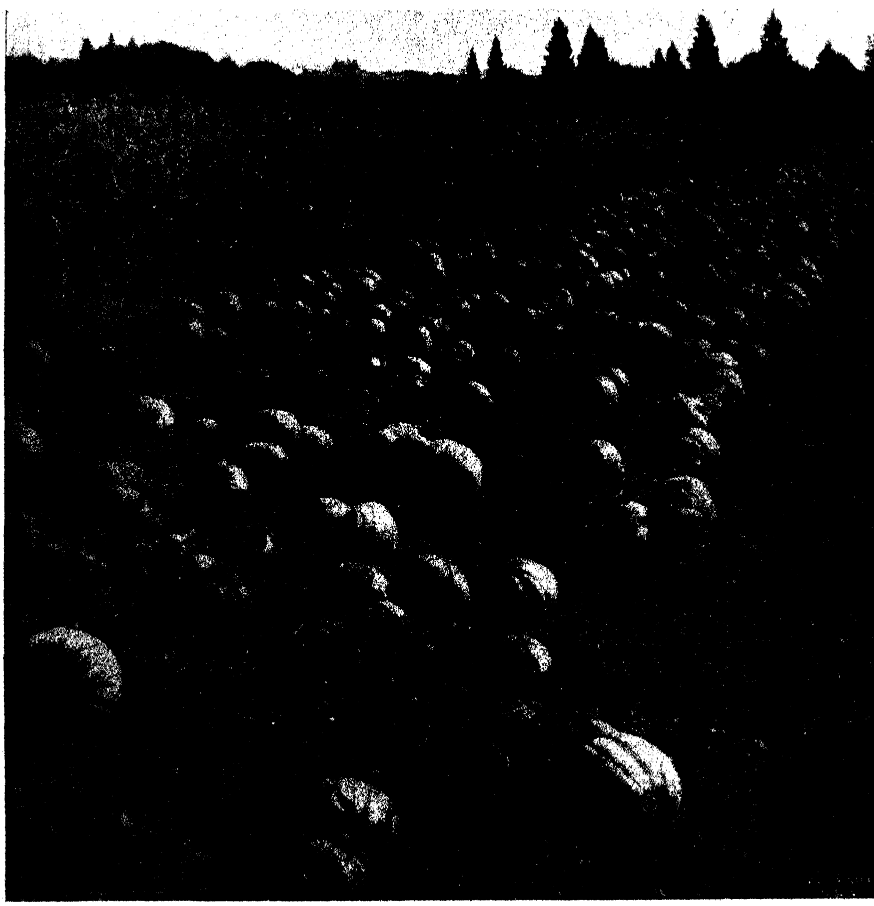
Deep *v.* Shallow Cultivation of Maize.

Mr. C. G. Williams, of the Ohio State Experiment Station, in a bulletin on maize, makes, *inter alia*, the following report, which is worthy of careful note by New South Wales maize-growers who think that so long as the cultivator is run between the maize rows it does not matter how deep the teeth stir the soil:—

"Experiments in deep and shallow cultivation of maize were carried on for nine years. Deep cultivation consisted in working the soil with a shovel-cultivator to a depth of 4 inches, and shallow cultivation in stirring the soil with a spring-tooth cultivator to a depth of 1½ inches. The average results for the nine seasons show that the shallow-cultivated plots yielded 4 bushels of grain and 213 lb. stover more per acre than the plots receiving deeper cultivation.

Triamble Preserving Melon, Bathurst Farm.

The accompanying photograph represents a patch of this melon grown under irrigation. The crop proved a very heavy one, yielding at the



A patch of Triamble Preserving Melons at Bathurst Irrigation Farm.

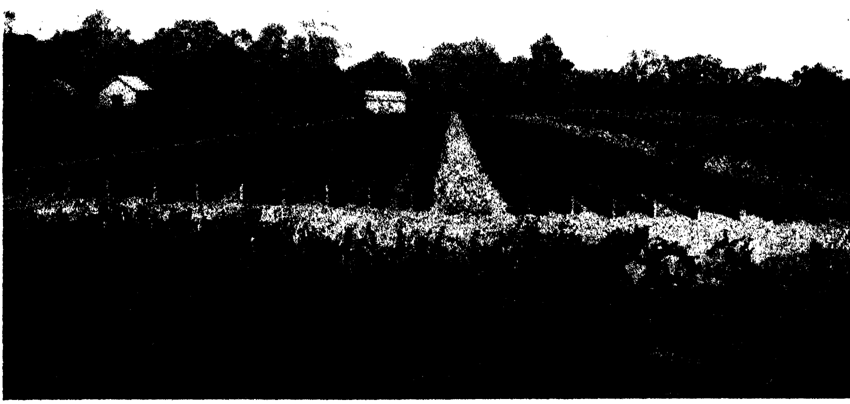
rate of 57 tons 10 cwt. per acre. These melons are supposed to be a hybrid of the citron preserving melon and the gramma. *Vide Gazette*, July, 1903.—R. W. Peacock.

Grafting European Vines on Phylloxera-resistant Stocks.

M. BLUNNO.

THERE are several ways in which European varieties of vines may be grafted on phylloxera-resistant stocks. One, is to strike cuttings of resistant vines in a nursery; the following winter to remove the rooted cuttings from the nursery to a work-room, graft them at the bench with European scions, tie them and plant these grafts out in the vineyard. (Fig. 1 and Fig. 2.)

My own experience at the State Viticultural Station at Howlong is that this method is not very satisfactory. Not only do many grafts fail, but even those which do take make a very poor start and do not



A general view of the Nursery of phylloxera-resistant stocks at the State Viticultural Station at Howlong.

reach the standard of vigour for two or three years at least. The dexterity in grafting is here beyond question. The grafts referred to were made by our Mr. Ellis, who is an expert handler of the knife. If anything may have contributed to lower the percentage of the successful grafts, I may consider that the roughness and newness of the ground, which had just been cleared from green timber, the continued drought, and the damage done by rabbits and cutworms are certainly responsible to a very great extent in accentuating the disadvantages of the system. My experience of it is corroborated by

that of other experts in Europe. Thus the late Professor Dufour of the University of Lausanne who, up to the time of his death was in charge of the Station Viticole of Champ de l'Air, expressed himself against the system in question. During the last few years it has fallen into desuetude almost everywhere.

Some vignerons of this State to whom the Department supplied rootlings of resistant stocks would graft those rooted cuttings the same season they received them, against the advice given them by the writer, and the results, naturally, have not been satisfactory. They thought that they would gain a year. They did not. On the contrary they lost time, because many plants had to be replaced and regrafted.

It is a peculiarity of the vines grafted on *Riparia* that the scion always outgrows the stock. This inconvenience is much less accentuated with stocks other than *Riparia*, and with certain kinds both stock and scion grow equally and form a stem of even dimensions all through. (Fig. 3.) Scions grafted on *Riparia* x *Rupestris* hybrids usually do not conspicuously outgrow the stocks, but if the graft is made after the system referred to they are apt to do so. (Fig. 4.)

Not much better is the system of striking in nursery the cuttings of resistant vines, removing next season the rootlings from

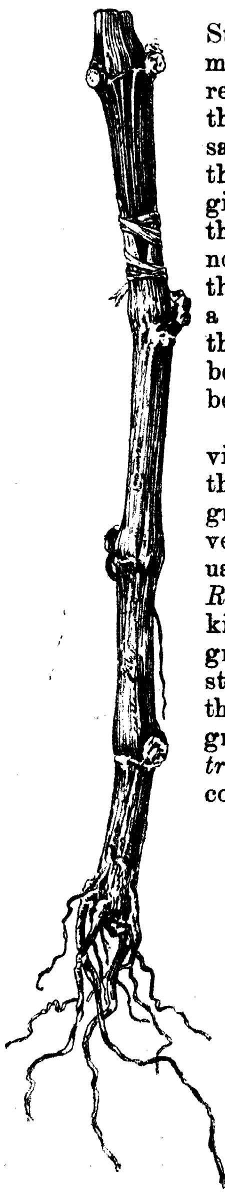


Fig. 1.

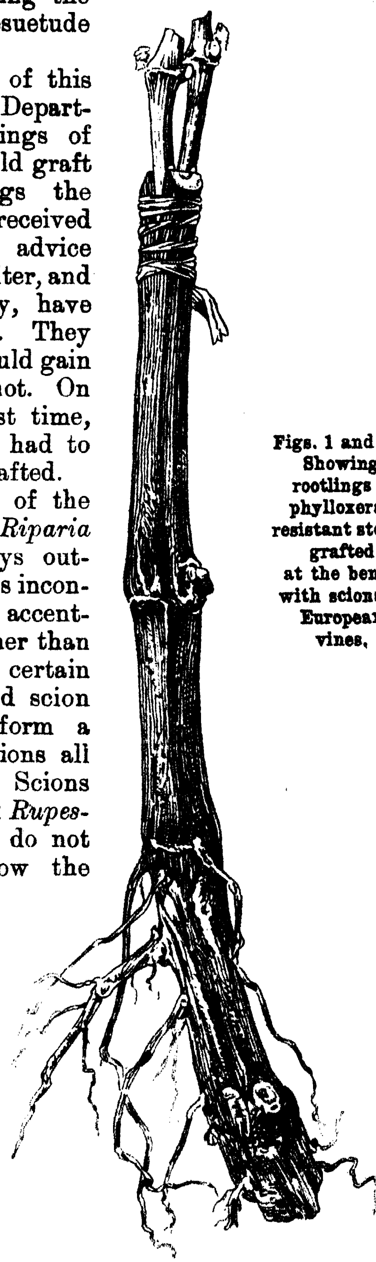


Fig. 2.

Figs. 1 and 2.—Showing rootlings of phylloxera-resistant stocks grafted at the bench with scions of European vines.

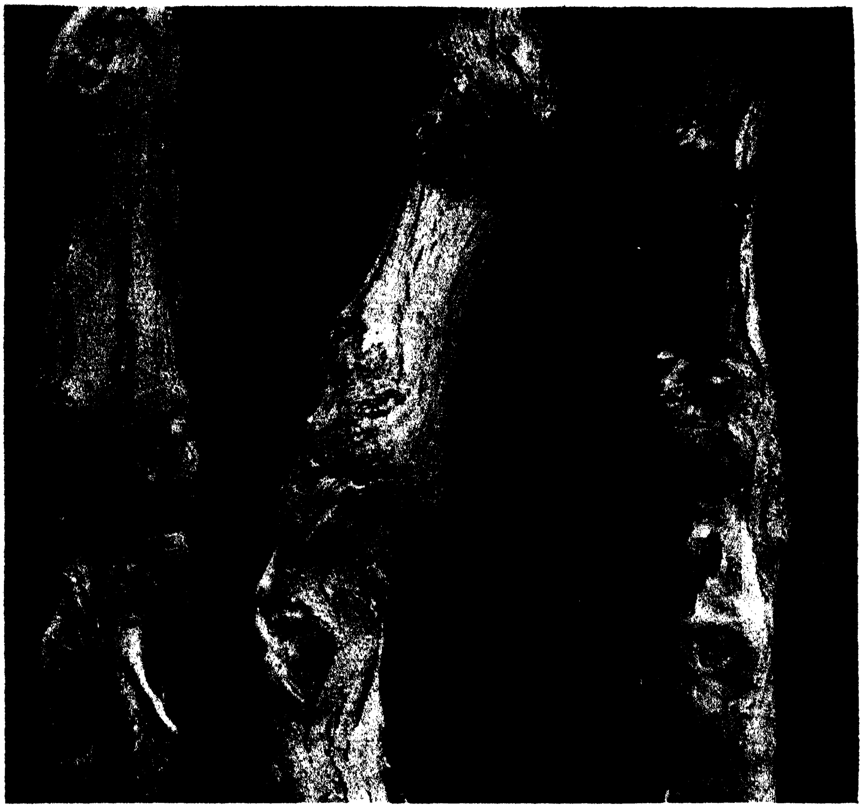


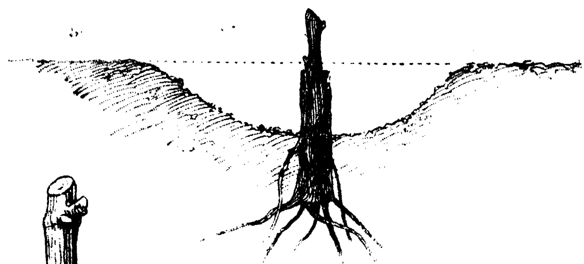
Fig. 3.—Showing portion of the stem of table grape-vines grafted on *Rupestris du Lot*. The knitting of stock and scion is perfect, and it is difficult to detect where the graft is. (State Viticultural Station at Howlong.)

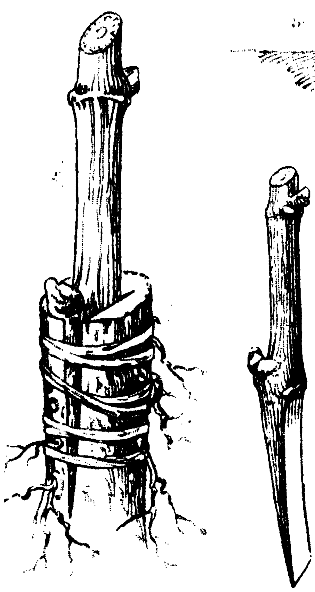
Fig. 4.—Thompson's Seedless on *Riparia* × *Rupestris 3306*.

the nursery to the work-room, graft them at the bench and replace the grafted rooted cuttings back into the nursery for a year to allow them to heal, and finally transplant the grafted rootlings from the nursery into the vineyard. It takes two years before the vigneron would get the *worked* rootlings, which would have necessarily suffered through having been twice transplanted.

To avoid at least one transplanting, the grafts on the rooted cuttings might be done in the nursery instead of in the work-room. A better method is to plant out the vineyard with vigorous cuttings or rootlings

Fig. 6.





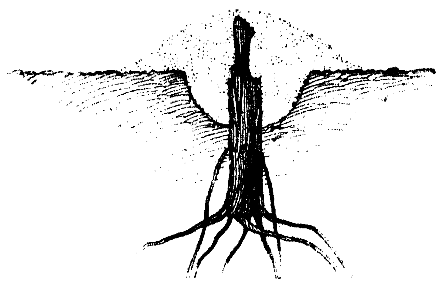


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Fig. 5. Fig. 7.

Showing how grafts are made *in situ*, that is, on stocks which have been growing one or two years in the vineyard.

of phylloxera-resistant stocks. Mind the young plants very carefully all through the growing period, rubbing off all suckers coming from below the soil, to allow that portion of the stem, on which the graft will have to be operated, to grow strong, straight, and smooth, and then next season graft on them in the usual way, as ordinary vines are grafted—half an inch below the soil. (Fig. 5, Fig. 6, and Fig. 7.)

The first year of the establishment of the State Viticultural Station at Howlong we followed the first method, which the year following we abandoned, and grafted on the young stocks that had been allowed to grow one year in the vineyard. Sixteen vines of each of twenty-nine varieties of table grapes were so grafted on the *Rupestris du Lot*, making a total of 464 grafts, which gave an average of 95 per cent. of successful ones—a very good percentage if we take into account the

unfavourable season. More remarkable is the fact that all these grafts, although a year younger, have borne a regular crop, and are in every way more advanced in vigour than the others which are a year older.

The number of vines per acre in Australia varies from 900 to 1,700. This suffices to show that the grafting of grape-bearing vines on phylloxera-resistant stocks, according to any of the above-described methods, entails a long and tedious work. Yet a small plantation may be reconstructed that way, but it becomes a herculean task when the vineyard to be formed on resistant plants is of fair size. Let alone the actual work of grafting, a long one in itself, it is also necessary to take into account the various cares required to secure success:—to repeatedly loosen the heap of fine soil or sand earthed-up around and over the scion, in order to break the crust and allow the young shoots of the scion to break through; to carefully remove the soil round the stock, and reach with a knife at the insertion of suckers and remove them; to drive close to every graft a small stake, and tie the shoots to it, to prevent damage from strong winds; then, towards the end of summer, to cut off the roots grown on the scion; and finally, during the following winter, to loosen or cut away the tying if it still grips the graft; all this is an additional work that requires the attention of the vigneron during the whole of the year following the actual operation of the grafting.

For several years past, and so also at present, the European vignerons who had to replant extensive vineyards have followed a speedier method, whereby a grafted rootling is obtained in one year. It consists in grafting a cutting of phylloxera-resistant vine with a scion of European variety. Usually the so-called "double cleft graft" is adopted. (Fig. 8.) The cuttings so grafted are planted in a nursery,

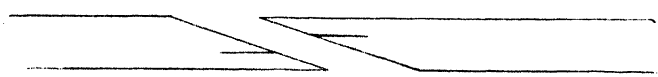


Fig. 8.

where the stock emits its roots and welds with the scion, and the following year the grafted rootlings are ready to be planted in the vineyard. In the early time of its adoption the system was rather imperfect, and many erroneous ideas were entertained. I still recollect, when at College, that special stress was laid on the manner of tying the graft. Between the spirals of the tie no space was to be allowed, in order to prevent any contact of the air with the freshly-cut tissues; and, furthermore, a mixture of resin and wax was smeared over the tie. Now, on the contrary, it is demonstrated that the action of the air on the tissues fosters the healing and the knitting, and therefore the tying-up should be firm enough only to keep stock and scion together until they weld, but between one spiral of the tie and that immediately following there should be a space of one-twelfth of an inch or so. As a matter of fact, when special care is taken of the grafted cuttings they are not tied at all.

In spring the cambium cells—inner bark of a plant—are in active prolificacy, and originate a new ring of wood and a new leaf of the

liber. The success of the graft is held to depend on the intimate contact of the inner bark of the stock and that of the scion. So it may in an ordinary system of grafting when nature is left to itself to do the welding of the two subjects. However, if the grafted cuttings are placed for about three weeks in a place where a temperature of from 70° to 90° F. is kept with a suitable degree of moisture, all the sections of the grafts—that is, all the cuts operated—produce an abundant whitish mass of cells which grows larger every day, not only in between the clefts, but all around them, until the grafted zone is enclosed like in a ball of white wax. The top cut of the scion and the bottom cut of the stock produce similar masses of cells, which also break out here and there from the inner bark all along stock and scion. (Fig. 9.) This tissue is commonly called *callus;* it is

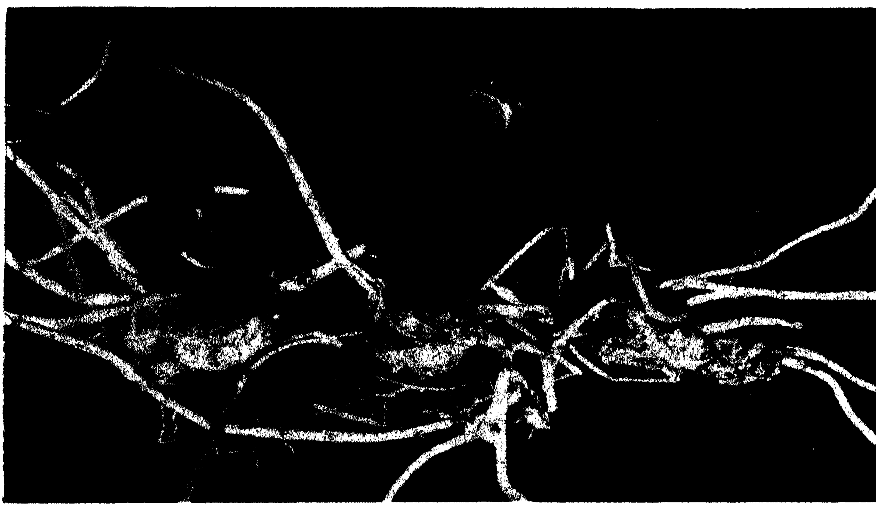


Fig. 9.—Vine-cuttings that have been kept at 85° Fahr. for three weeks, bedded in moss in a wooden box. They show an abundant callus at the end, from which young roots have evolved already. (State Viticultural Station at Howlong.)

all an aggregate of sappy cells, and histologically is a *meristem.* The callus is gradually absorbed, thus originating within itself that differentiation of tissues whereby a zone of pith, wood, and bark are formed which unite the stock to the scion and make one whole of the two. Suppose that the inner bark of the scion does not coincide with that of the stock. Under the ordinary conditions that graft would fail; but put stock and scion—the inner barks of which do not coincide—put them in a box with sand, or sphagnum moss, or any other porous material, in which a suitable degree of moisture is kept, and a temperature of 80° to 90° Fahr. constantly maintained, and that graft, if well cared for afterwards, will take and form a vigorous plant. Further, if the scion is not cut with the tongue-shape as usual, and the stock is not split to receive and grip the tongue, but the two round sections of stock and scion are simply

brought in touch, even then the two subjects will knit together on account of the intervening callus, which will cause the formation of neatly-differentiated tissues that will link them together.

Yet again, if by any accident while the grafted cuttings are callusing in the heated box and packed in the porous material as above described, the scion should detach itself from the stock, and half an inch or even 1 inch of space should separate them, it may occur that the callus plentifully formed at the top end of the stock and the callus formed at the bottom end of the scion will meet, and this will establish the contact between the two subjects. Gradually, if this graft is taken care of, hardened under glass before it is removed from the heated box to the open air in the nursery, the callus will evolve within itself the bark, the wood, and the pith, and so establish continuity and communication between stock and scion.

Cold weather prevents the formation of callus; when vines are grafted in the nursery or in the vineyard, it is during spring-time that the process of welding takes place. Even in spring only a few hours of the day are favourable to the formation of callus, which is almost stopped as soon as the temperature falls below 60 degrees F.

For grafts in the open air it is necessary that the inner barks of stock and scion should be in contact, because the new tissues which must link them together, form slowly. Their cambium being in close touch, only a few layers of cells will be necessary to establish the first communication between the subjects, and they will be readily supplied by the respective cambium of stock and scion, it being a natural function of the inner-bark of every plant to produce every spring new cells, from which will gradually evolve an additional ring of wood and a new leaf in the liber. The healing up and knitting is gradually and slowly accomplished throughout the season.

Grafting cuttings of resistant stocks with cuttings of European vines has many advantages over any other system, for the following reasons:—

(*a*) The operation is done in a work-room independent of the weather, and, therefore, can be carried on all through the winter months.
(*b*) Boys and women can be trained in this work, which is clean, and can be done comfortably in a sitting position.
(*c*) The grafted cuttings will give in one year grafted rootlings which will be fit to plant out in the vineyard the following winter.
(*d*) Can be done by lamp-light, and may, therefore, be protracted until late hours.
(*e*) It is quick work.
(*f*) Machines have been constructed for making the tongue on the scion and splitting the stock, thus reducing the hand-work to inserting the tongue in the split.
(*g*) Tying the graft may be done away with.

Recently some very interesting experiments have been carried to define the most favourable conditions to the formation of callus,

inasmuch as it is certain that a graft well callused before it is planted in nursery stands a better chance of "taking."

In such countries as South of France, Sicily, and anywhere else where the winter is mild and the spring is warm, the cuttings grafted in winter are stratified in sand containing about 10 per cent. of moisture, and kept in a place well protected from cold winds and from any sudden change of temperature. The stratification in sand under such conditions usually is enough to cause the grafts to callus nicely before they are planted out in the nursery. In some places they even do without the stratification in sand, but plant straight away the grafted cuttings in the nursery, as it is maintained that under a genial climate the callusing takes place in nursery just as well as if they had been kept for seven or eight weeks in sand.

Clean cuts operated on the stock and the scion are necessary, because when the sections are neat, and not contused or lacerated, the formation of the callus is readier and more abundant.

The cutting used as stock, and that used as scion, shall be of the same size, so that they will fit well one in the other. When working, a gauge is used (Fig. 10) for assorting the cuttings, dividing them in lots of various thickness. No cuttings should be grafted which are under a quarter of an inch in diameter.

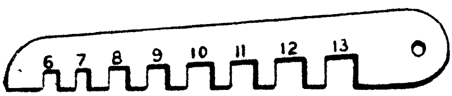


Fig. 10.

The double cleft graft is generally adopted, consisting in making a sloping cut on the stock and a similar one on the scion. The length of the section should be about three times the diameter of the cutting. The incision is then made on both stock and scion on the first third of the sloping cut. This incision is about $\frac{1}{4}$ of an inch deep. (Fig. 8.) Then the two cuttings are inserted as shown in Fig. 11.

In some establishments the so-called Richter's rings are used for making this sort of graft. They consist of brass tubes sloping to a point. The end of the cutting is put through the ring, the sharp edge of the knife follows the sloping section of the ring, thus a clean cut of the required dimensions is obtained. (Fig. 12.)

If the operation is well done no tying is necessary, and not even any resin and wax mixture. The grafted cuttings are then stratified in sand until beginning of spring, when they are planted in nursery. If there has been no time to submit them to the stratification, then they are planted in nursery right away. It is a good plan to plant in the afternoon all the bench-grafts made in the morning.

Experiments made in Europe show that a trained workman can make 600 bench-grafted cuttings, an apprentice about 350 per day.

The percentage of grafted rootlings obtained, that is the proportion of grafts that take, varies from 30 to 50 per cent., according to the season, and to the sorts of Phylloxera-resistant stocks employed, and of the European varieties used as scions. Such percentage may at first appear low, but if we consider that a man grafting cuttings in a work-room can make three times or more the number of grafts that he could make outside in the nursery or in the vineyard operating on

rooted vines, that all the winter can be utilised for this work, and relays of men may be employed for night work, that the cost of the cuttings, whether for stocks or for scion, is infinitesimal for any vigneron who has a number of mother plants from which he can get the necessary canes, it will be realised then that this system is the quickest and least expensive for the rapid reconstruction of large areas. The proportion of 30 to 50 per cent. above referred to is constituted of real first-class grafted rootlings, showing a complete knitting and healing of the tissues, such in which no flaw is made apparent in the grafted section by bending and twisting it. The proportion would be higher if all the grafted rootlings were included which, when submitted to the test of bending and twisting, fail to show a complete union along the line of the graft, but it is advisable only to plant those first-class, because the others would never give a complete success when planted out in the vineyard. The latter might during the first year or two show nice strong shoots, but by degrees the rot would invade the tissues where there is a lesion on the line of the graft, and eventually might bring about the death of the plant, or in any case the plant would ever remain a weak one.

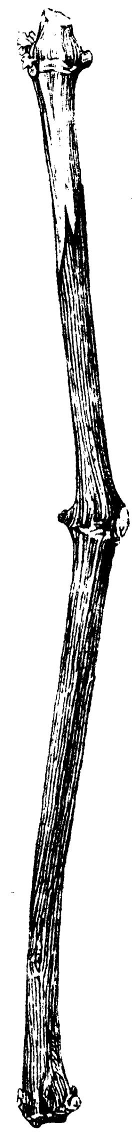


Fig. 11.—Double-cleft graft between a cutting from a phylloxera-resistant stock and the scion of a European vine. (State Viticultural Station at Howlong.)

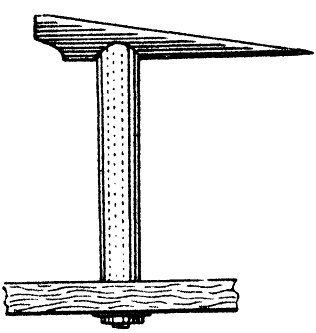


Fig. 12.

Vineyards that will have to be planted in difficult soils should be always constructed with good ready-grafted rootlings.

Since grafting between cuttings came into favour, several machines were invented for doing the work. The first ones put on the market did not appear to be much availed of; as a matter of fact the work can be easily learnt and done by hand, and machines would only be resorted to if the machine-made grafts were as neat as the hand-made ones, and in addition turn out a larger number of them. By degrees the mechanism was simplified and improved, and there are now one or two of these contrivances which do fairly neat and speedy work. The constructors of such machines naturally claim that as many as ten times more grafts can be made than by hand, still it must be recognised that for certain kinds of grafts, such as the shoulder graft, which requires the splitting and double outwardly-sloping of the stock and

the making of a tongue and double inwardly-sloping of the scion, machines make a far swifter work than it would be possible to get through by hand. (Figs. 13 and 14.) For me it is open to question whether by making so many sections in stock and scion is an advantage. The more cuts operated the less the chance of complete healing and union. When grafting skin on the human body it stands to reason that the larger the sore the smaller the chance, or at least the

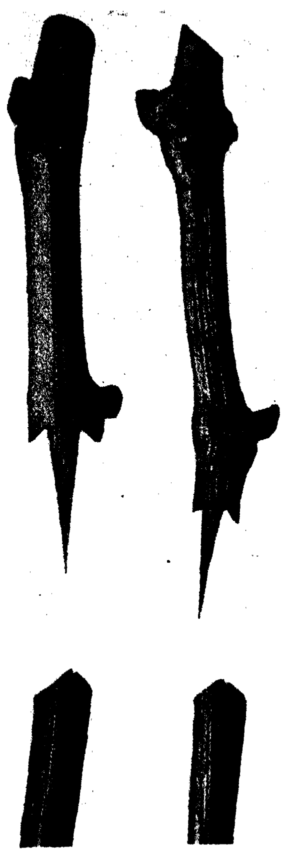


Fig. 13.—Shoulder grafts between cuttings of resistant stocks and scions of European vines—made by machine—at the State Viticultural Station at Howlong.

Fig. 14.—Shoulder grafts showing the insertion of the scion on the stock.

longer the time required, for a complete healing; also two pieces of a fractured bone of a limb will join again more easily and better if the fracture is neat, that is, if the surface of the fracture is smaller. This view is perhaps corroborated by the fact that splendid grafts can be obtained by joining two cuttings end to end and keeping them together by a small pin, part of which is thrust into the pith of the stock and part in the pith of the scion.

The double cleft grafting is good and simple enough for a graft between cuttings. Machines are hardly required for it.

I explained in the foregoing that the callusing cells grown by the sections of the graft are the initiatory healing tissues, and that a certain degree of moisture and heat are indispensable for their formation. In this connection there is a maximum of favourable conditions under which the production of callus may take place, and although as far back as twenty years ago the importance of the callus had been brought in evidence, yet only quite recently some exhaustive experiments have been carried out which have thrown light on the subject.

Verneuil, Viala and Ravaz, Rougier, Richter, Foëx have all written on the argument. Three years ago Dr. Briganti, assistant to the Chair of Viticulture at the Viticultural College of Avellino (Italy), made comparative trials by keeping a certain number of grafted cuttings bedded in moss in wooden boxes, and maintaining one box at the temperature of 54° F., another at 60°, a third at 68°, a fourth at 77°, and the last one at inconstant temperature.

The results were:—

Box.	Grafts contained,	Temperature in F. degrees.	Percentage of successful grafts.
No. 1	60	54°	20
2	60	60°	82
3	60	68°	76
4	60	77°	72

The highest temperature, viz., 77° F., caused the grafts to produce callus abundantly in a fortnight, although the percentage of good grafts has been lower, and this is accounted for by the fact that when the grafted cuttings were removed from the incubator and planted in the nursery, the temperature of the air and that of the soil were much below that to which they had been accustomed.

It took twenty and thirty days respectively for those kept at the temperature of 68° and 60° to properly callus.

If for want of time or want of space, or any other reason, the incubating process must be necessarily shortened, and the temperature increased in consequence, it is advisable, according to the results of the experiments, to allow the callused grafted cuttings to remain for a few days to a decreasing heat before planting them in the open.

The lot of grafts submitted to changes of temperature mostly failed.

At the beginning of this article I stated that in countries where the winter is mild the preliminary callusing obtained by artificial heat is dispensed with, and that the grafted cuttings are planted direct in nursery. Yet I am convinced that even there it would be most advantageous, in order to increase the percentage of good grafts, to submit them to a suitable artificial heat for a fortnight or so, then slowly decrease the temperature, and so prepare them—that is, harden them—to withstand the ordinary conditions of weather in the open. In cold climates, such as some parts of Italy and in France, it is considered as absolutely necessary that the grafted cuttings be so treated before being planted in nursery. For instance, in the

Champagne district the well-known firm, Moët et Chandon, found it imperative to erect a regular factory for the production of ready-grafted rootlings. When visiting Epernay I had the privilege of going through an up-to-date establishment—the only one of the kind in the world—where the system of grafting cuttings of phylloxera-resistant stocks with cuttings of European vines is carried on on a large scale, and with an organisation based on the results of valuable experiments previously carried out, and that have thrown so much light on a subject about which everybody speaks more or less empirically. There I saw special underground cellars, where the canes that will supply the cuttings are kept during winter. When the winter season is about to end, grafting on cuttings begins. Women are employed for this work; they sit at different tables in large, well-lighted rooms, with water tanks in which the cuttings are dipped before they are worked. All the cuttings so grafted, and without being tied, pass from these rooms to a next one, where they are packed in wooden boxes, which are lined with moss. The moss is mixed with 5 per cent. of wood charcoal, in order to prevent the development of moulds. The bottom of the box is also lined with the same substance, and when the case is filled the top is covered with a layer of about 2 inches of finely-cut moss. All the boxes are then placed on tiers in a large room supplied with pipes, in which warm water is run, and the chamber is thus nothing but a great incubator, in which the temperature of about 85° F. is constantly kept. As the top layer of moss is apt to dry at such temperature, a second layer of coarse moss is spread over, but it is kept separate from the lower one by a net, so that when the moss on top gets too dry, the net with the coarse moss is lifted, moistened with water, and put back again on the top of the case. In such wise the layer of fine moss, which is in direct contact with the top of the scions of the grafted cuttings, is continually kept in a suitable condition of moisture. In a fortnight or so the grafted cuttings show already an abundant callus; soon afterwards the stocks begin to emit roots, while the scions break out in shoots. If the moss lining the sides and the bottom of the boxes get rather dry, the box is gently dipped in warm water, and for that purpose the bottom of the boxes is perforated with a series of small holes. After this dipping the case is put back on its stand. When the young shoots emitted by the scions begin to break through the layer of fine moss that is on their top, then the upper layer of coarse moss with the net is removed in order to give said shoots a chance of coming out. When they are all out and have attained a height of 2 or 3 inches, the boxes are removed from the incubating chamber and put in a glass-house where the temperature is lower. Here the shoots and the grafts harden, and at last the grafted cuttings are taken out of the box, and they have not only a strong callus but the stock has already developed a certain number of roots, while the scions have already one or two small shoots. (Fig. 15.) In this state they are planted in nursery. By this time the weather is milder, spring is well forward, and the young grafted plants have not much to fear from frosts or from sudden changes of temperature.

With this system the firm Moët et Chandon obtain in the cold climate of the Champagne district the same results as the vignerons who work in the more genial climate of Southern France, and who can afford to plant straight out in nursery the bench-grafted cuttings. The percentage of successful grafts is about 40. Without such organisation as that shortly described, this kind of graft would be out of the question in Champagne.

When planting out in the nursery the bench-grafted cuttings, whether they have been previously callused or not, certain precautions are imperative. I should think it is superfluous to describe the kind of soil necessary for a nursery. Everybody knows that the ground for this purpose must be rich, very loose, very deep, very well stirred, and that the presence of any proportion of clay in such ground is absolutely objectionable. The grafted cuttings are planted in rows, between graft and graft a space of about 3 inches is allowed, and between the rows such space is allowed as to permit the work with a Planet Junior cultivator.

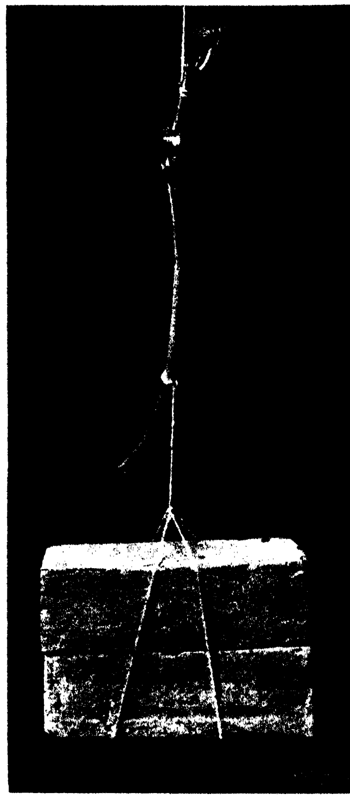


Fig. 15.—Graft made by machine between a resistant stock and a European scion. After about three weeks of callusing process in moss at 85° Fahr., and a few days hardening under glass, the graft stood the strain of 14lb.

(State Viticultural Station at Howlong.)

The usual length of the stock is about 14 inches. In hot climates I am in favour of deep planting; it is in fact the rule all over the vine-growing districts of South Europe; it is necessary, therefore, to think of this when making cuttings of phylloxera-resistant vines, which will have to serve as stocks. The trench in the nursery should in consequence be a couple of inches deeper than the length of the stock. At the bottom of the trench, and right against the side, a small ridge of sand is placed, on the sand rests the bottom of the stock, thus the section of the graft is just above the level of the ground. The soil of the trench is thrown back, lightly pressed against the cuttings, and then, to protect the sections of the grafts, which, as I said, must be just above ground, a ridge of sand is formed on each side of the row. Some little water is finely sprayed over this sand as if to seal the grafts, then the ridge is made bigger and is completed by earthing up very fine soil until all the tops of the scions are under a layer of earth of half-an-inch or so. (Fig. 16.) This ridge will in the course of a few days form a crust which must never be allowed to harden; it is therefore,

often gently broken and loosened. In May of last year, I was in Sicily, and I saw this work being done without any instruments. The ridge was undone and done over again with the hands. In due course, the stocks throw out roots; from the two eyes of the scions shoots break through the ridge, while the same scions will also emit roots on their own account, which feed in the soil of the ridge earthed up to protect the grafts from the elements. These roots of the scion are a help for the first period of the season and contribute to the union with the

Fig. 16.—Showing how hand-grafted cuttings are planted in Nursery.
(State Viticultural Station at Howlong.)

stock, while this is striving to emit its own roots, which will have very soon to feed the whole plant, and also strive to unite with the scion. About midsummer, the union is well forward, the roots of the stock are already developed enough to feed it and the scion, therefore, the roots growing on the scion are no longer required and must not be allowed to further grow. If they did, the two parts—stock and scion—would most likely disunite and grow independently. The roots of the scion must be cut. At one time it was usual to thrust a sharp blade

in the ridge close to the scion on both sides and sever them, but now it is recommended to just remove by degrees the outer layers of soil that makes up the ridge, so that the heat of the sun may reach them and dry them up. In autumn the ridge is levelled down, the graft now is strong enough not to fear the mild autumn sun; it is, in fact, a good thing to do as the healing tissues will harden and lignify by being exposed to the air.

In Spring, while the young shoots are growing, they will be certainly attacked by cut-worms, which are among the worst enemies of many vine nurseries. These grubs in day time are hidden about an inch below the soil, and eat the portion of the shoot that is underground, and at night time they come out and finish the work of the

A section of the Nursery.

day. We have found at the State Viticultural Station at Howlong that baits of pollard and Paris green will kill some of them, but for all that they still remain a great nuisance, and many grafts are lost through them. The shoots must also be protected from fungoid disease, and spraying with Bordeaux mixture is another necessary work. It is needless to add that the soil between the rows must be kept always clean of weeds and in good order, and that in dry districts or in dry seasons irrigation is necessary.

When the grafted rootlings are grafted from the nursery, the young plants should be carefully handled, and a selection is made. Only those which show a perfect union will be planted out in the vineyard; those in which the grafted section show any flaw should be discarded.

If the rootlings are not planted right away, then they are bunched and buried in a trench in the nursery, allowing the upper half of the stem to remain above ground.

When the vigneron is ready for planting in the vineyard every individual rooting is examined; those roots that have suffered in lifting the plants from the nursery are cut off, all the others are trimmed. It is the practice with some growers to trim the rootlings so drastically as to leave a few roots only 2 or 3 inches long. On the contrary, at least 7 or 8 inches of roots should be left. All young canes are cut off, except one, which is cut back to two eyes.

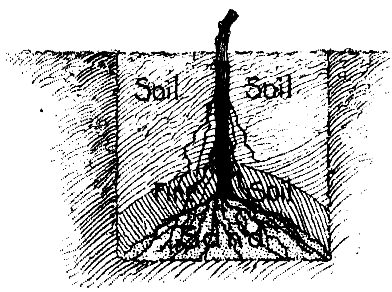


Fig. 17.—Showing how a ready grafted rootling is planted out in the vineyard.

For planting the rootlings properly, holes are dug in the vineyard about 17 inches deep; at the bottom are placed about 3 inches of sand; the roots are placed all round the stem like spokes in the hub of a wheel, but with a downward direction; to do this the sand that is placed at the bottom of the hole is heaped so as to form like a cone. The bottom of the stem resting on the apex of the cone, the roots are placed down along its sides; then they are covered with some fine earth which is lightly pressed on them and against the butt; finally the hole is filled level with the ground with more fine soil, which is also lightly pressed. (Fig. 17.)

The greatest attention must be paid to plant the rootlings so that the graft is just level with the ground, or, at most, ½ an inch below.

Rape at Bathurst Farm.

The following is the result of an application of chemical fertilizer upon rape at the Bathurst Farm.

Twenty-eight and a half acres were sown broadcast at the rate of 7 lb. of seed per acre on 15th February, 1904. A complete fertilizer, No. 3, containing 13 per cent. of soluble phosphoric acid, 2 per cent. potash and 13·3 per cent. nitrogen, was applied at the rate of 1 cwt. per acre. One width of the drill, 8 feet, was left unmanured. Ten weeks after sowing the growth was but a few inches upon the unmanured portion, while the whole area manured was over 30 inches in height.

The soil is a light one and the paddock had been fallowed during the preceding spring.—R. W. Peacock.

Hawkesbury Agricultural College and Experimental Farm.

THE PIG INDUSTRY.

H. W. POTTS.

III.

The Sow.

THE selection of the sow for breeding purposes, whether it be for raising stud pigs, porkers, or baconers, demands careful study and keen judgment. It is considered that the sow furnishes the internal organisation on which digestion depends, and the progeny's capacity to fatten, as well as breeding qualities. Where the breeder caters for the supply of meat to the butcher, the market demands, with all their profitable attractions, must be steadily kept in view. Definite characteristics are sought for, such as early maturity, length in frame, broad and well let-down hams, vigorous and robust habits when rearing pigs for slaughter; whereas the conditions essential for breeding animals intended for stud purposes are more complex, and entail a wider range of attention.

The young sow, before she has had a litter, is known as a "yelt." When establishing a pig farm, it is best to purchase yelts before they fully mature, and when in moderate store condition. Each yelt should be selected from a large litter noted for activity, vigour, even make, and great vitality. She should be compact, though roomy, with long quarters, broad loins, a good girth, a strong back slightly arched, and fine short legs. She should possess a kindly disposition, docile temperament, be cleanly in habit, and have well-formed udders—twelve or fourteeen teats should be clear and distinct, well-developed, and placed equi-distant. She should be narrow at the top of the shoulder, and light in the second thighs. Sows with wide-topped shoulders and short necks rarely turn out good sucklers. A poor suckler is invariably a slow breeder.

It is as well to reject sows that show a tendency to fatten. In all breeds, especially those distinguished for fattening quickly, the vitality and strength of the yelt is heavily taxed in making rapid and vigorous growth, and to impose upon the animal at the same time the additional burden of producing young tends to make a failure of both. We need only contrast the litters from immature yelts with those from old sows. The latter are greater in number, twice the size, and more vigorous and thrifty.

Yelts should not be less than ten months old before being sent to the boar. If maternity be forced on the yelt under ten months, it may

result in immature stock, and the litter few in number. A yelt in our warm climate will show evidence of sexual heat as early as five months. When she is desirous of the boar's company she will exhibit some restlessness, and utter distinctive and peculiar cries or grunts; the sexual organs become enlarged, the vulva protrudes, and is inflamed and swollen. In many cases she attracts attention by jumping on other sows' backs. Some yelts, and even old sows, however, exhibit few, if any, of these signs to the practised eye. A yelt may obstinately refuse to be served, and in such case she may be sent to another boar.

Sexual heat, or œstrum, lasts about three days, and will recur every twenty-one days. Should the sow fail to give any signs she may be turned in to the boar, and he will soon find out. In some instances it is necessary to feed the animal on some stimulating food, such as barley, wheat, or maize to induce œstrual heat.

It may not be suitable to breed from pure bred sows. Good sows from the old original Berkshire breed, or the crosses, are more inclined to be coarser in character, but they are prolific, hardy, good mothers, and noted for converting their food into rich milk. The pure bred sow's milk is invariably richer in fat.

The first crosses—*i.e.*, the progeny of pure bred parents of different breeds—make excellent mothers. A fidgety, ill-tempered sow is not a success in rearing a litter.

It is most convenient at this stage to discuss the yelt; and having selected her in sound condition she may be put to the boar early in May so as to farrow in August or September. Early spring litters thus avoid the extremes of heat and cold at a critical period of their growth, and are readily weaned in six to eight weeks.

Some skill and judgment should be brought to bear in the matter of mating. Where possible, select one animal with superabundant qualities that are deficient in the other so that these may be lessened or obliterated in the progeny. After the yelt is stinted, mated, or served, she should be turned into a well-grassed paddock with access to an ample supply of good water. Shade and protection from harsh winds, rain, or the extremes of heat and cold should be available. It is unwise to provide food too easily reached. The aim is to keep the animal in a sturdy and healthy condition by forcing her daily to get enough exercise in search of food. Mixed native grasses, *Paspalum dilatatum*, prairie grass, rye, cocksfoot, couch, sheep's burnet, lucerne, or clover are all serviceable, and each form fairly well-balanced rations. Lucerne and clover provide a higher proportion of protein or albuminoids than the others as food suitable to the growth of flesh, muscle, and bone. Where grazing is not available, then root-crops should be fed, such as turnips, mangolds, beets, sweet potatoes, or rape, with grain.

Breeders require to keep a watchful eye on the sow's condition during this period, and regulate her diet to prevent her getting fat. The aim is to keep the animal in robust health, and to supply enough food to maintain healthy development of the unborn pigs. Further, we have to consider the period of farrowing, to meet the ordeal of which she should be in sturdy condition and able to suckle well.

Over-feeding is liable to induce premature farrowing, a fractious temper, and excitement as the farrowing period approaches. Moreover, the suckers are not fully grown, and the milking capacity of the sow is lowered. When the tendency to put on superfluous fat is noticed, the quantity and character of her food should be regulated to check it.

Sows are very fond of basking in the sun. It keeps them healthy and contented. A snug, warm, clean bed is always appreciated. Where a number of sows are kept, the cost of a shelter shed is money well spent.

In cold weather, it will be found advisable to add some starchy food to the grazing ration, such as maize or grain.

Strict precaution should at all times be taken to keep the sows undisturbed, in placid contentment. They should not be grazed with other animals, and any condition likely to create pain, apprehension, alarm, fear, anger, or undue excitement, should be rigidly avoided. The presence of a yelping dog on the farm is an instance where uneasiness is created. Give the animals undisturbed possession of a paddock, where they can develop all their useful maternal instincts without interruption.

The gestation period is 112 days, or sixteen weeks. This varies with some sows more or less. Parturition has happened 106 days after service, and as late as 142 days. Young sows or yelts with their first litter frequently farrow from 100 to 108 days.

During the third month, the food supply should be increased, bearing in mind that such is intended more for the production of nerve tissue, muscle, flesh, and bone, rather than fat. Heavier claims are gradually being made, not only in supporting the coming litter, but in stimulating milk production.

Three weeks, or two at the latest, before farrowing, the yelt should be brought in and comfortably housed in a well aired and drained sty, and given light easily-digested food of a relishable nature, such as kitchen slops and wastes, pollard, with a variety of green food. Feed at regular intervals, four times a day.

If constipation be present, as observed from the condition of the excreta, some laxative form of food, such as bran, may be added to the ration, or light doses of Epsom salts (3 oz.) or castor oil (2 fluid oz. or a wine-glassful) given in warm swill. Each day, she should be turned out for exercise and to bask in the sun.

Twenty-four hours before farrowing, on examination, the udders will be found full of milk. She should be supplied with a small quantity of short loose hay or straw, to make her bed. This she will do about two hours prior to the event. With long entangled bedding the young pigs are liable to get strangled.

Around the sty, a protection bar or batten, 3 in. x 2 in., should be permanently secured, 7 inches from the floor and 6 inches from the wall. This is to protect the young suckers from being injured and overlaid during the struggles of the mother.

An attendant should be present, especially with the yelt—one with whom she is familiar. Assistance is occasionally required. Sometimes, a sow will be found to be savage and troublesome just at that period, and

it is necessary to exercise some caution. With her first litter the sow rarely lies down, and as the suckers arrive she gives vent to a peculiar snapping noise, as if she intended to bite them. In some cases, if not prevented, she will do so, and end in eating them. As the pigs are born they should be taken charge of by the attendant, and placed in a box with a soft cloth or an old piece of flannel to keep them warm. An instance may happen where only a partial presentation is made; the head protrudes and becomes fixed. The attendant should lubricate his hand with oil, pass a cord around the inside of the mouth, make a slip-knot, and pass the cord over the snout. With gentle pressure the sucker may be drawn out at the next pain. The attendant's duty is also to see that the sow does not get a taste of blood, as this often creates the first incentive to the habit of eating her young. The parturition period in the yelt is longer than with the old sow. It often occupies an hour. There is also more blood, and this should be smartly cleaned up. Afterwards, make her comfortable on a clean bed, and place the suckers on the teats. The weakest should be placed on the teats nearest the hind legs, where they have more room and the largest supply. In about half an hour to an hour following, the placenta or afterbirth will be expelled naturally. This should be promptly removed and burnt, and all traces of blood cleared away. On no account give the young sow an opportunity of eating it. This, in her excited condition, creates a taste for blood. She may follow that up by licking the umbilical cord of the sucker, which finally induces her to eat or injure it.

It is considered good practice to promptly destroy any ill-formed puny sucker likely to prove a waster, and thus render more milk available for the profitable suckers. With old sows this is undoubtedly correct, but with the yelt it is an important object with her first litter to develop all her maternal functions for future litters. Under those circumstances it is better to allow her to rear all her suckers.

Should a sow persist in the vicious habit of eating her pigs, it will be best to convert her into bacon.

When the sow has been made cosy, clean, and warm, she should not be disturbed for at least eight or ten hours. She should then be roused and moved about so as to induce a free action of the bowels and to empty the bladder.

The first meal should be light and sloppy, and given lukewarm. The diet for the first week should be similar to that given prior to parturition—light, sloppy, palatable, and easily digested. Only give spare quantities at first, regularly, at least four times a day. Skim-milk, barley, pollard, slops, and green food are useful; the latter may include such succulent herbage as rape, vetches, lucerne, grass, cow-peas, or clover.

Avoid giving all classes of food likely to encourage constipation. See that it is given in a sweet, clean condition. The aim is to provide food that will produce milk—not fat or flesh. The qualifications of a good sow are similar to that of a dairy cow. A rich flow of milk during the suckling period is the chief object. The healthy and thrifty character of the pigs is also controlled by the class of food

given to the mother. If the suckers get diarrhœa, the sow's food must be scrutinised for the cause, and faults rectified. Sometimes the addition of small quantities of lime-water to the food will act in a wholesome way. When constipation in the sow is noted, the food must be altered to rectify this condition, or small doses of castor oil or Epsom salts administered in warm swill. The sty must be kept clean and sanitary, and enough bedding provided to maintain suitable warmth and comfort. The sow should have exercise daily.

The first litter of pigs from the yelt is rarely recognised as the maximum number she is capable of producing. That is generally determined by the second litter, and on it is the verdict arrived at as to the prolificness and motherly instincts of the sow. It has been shown that procreative vigour is transmitted to the offspring with the best motherly qualities.

The sow that gives a litter of ten pigs or more may be regarded as a wealthy addition to the pig-farm, not only for her own worth, but further for the merit of impressing her progeny with her best qualifications.

In a general way, the precautions needed to care for and nourish a sow during the breeding period, although specially designed to meet the wants of the yelt, can be applied in most phases to old sows. As a rule, the latter farrow with less risk, and they do not require the personal attention needed for the yelt.

After the first litter, sows rarely require assistance. When large, roomy crossbred sows are utilised for breeding, some judgment is essential to avoid sows that are likely to become ungainly, unwieldy, flat-sided, and weak-loined. They become clumsy, kill their young accidentally, and are not good mothers.

Rearing of the Young Pigs.

The management of the suckers really commences when they are three weeks old—when they begin to supplement the milk supply from the mother. Exercise in the open air and running about in the sun has a marked beneficial influence in keeping the young pigs thrifty. The stomach of the sucker is very small, and in consequence they should be fed frequently. It is surprising how frequently in the twenty-four hours they suckle the mother.

Weaning can be effected gradually by teaching the suckers to feed on milk slops, throwing a few grains of maize or a number of peas about to pick up. They soon learn to eat grass and forage for themselves. When they are sufficiently grown, in from six to eight weeks, they have acquired sufficient training and confidence to feed themselves completely at the troughs. They ought to be fed frequently. It is best to wean off the sturdiest and most robust first, and allow the weaklings to suckle the mother for another week or two.

Much importance is attached to the encouragement of exercise in the mother. If she can have access to a grass paddock from her sty, all the better. Sunlight and exercise are potent factors in the maintenance of vigorous health.

The sow will come on heat three or four days after farrowing. This is allowed to pass, unless some unforeseen accident has happened to the litter, when the sow may be served. Where the sow rears her litter, she can be mated again in the early part of November, so as to farrow and rear another litter before the return of the cold weather.

(*To be continued.*)

A Comparative Trial of Four Varieties of Broom Millet.

GEO. L. SUTTON,
Experimentalist, Hawkesbury Agricultural College.

Early in spring four varieties of broom millet were received from the Seed Bureau for comparison. The names of these were "White Italian," "Long Brush Evergreen," "Californian Golden," and "Improved Dwarf Evergreen." These varieties are the best known, and are considered the most suitable for broom making. They have been imported by the Department with the object of testing their comparative suitability for New South Wales.

As "White Italian" was by repute the best of these varieties, it was decided to use it as a standard with which to compare the others. The experiment was, therefore, so arranged that a plot of "White Italian" was growing on both sides of and adjacent to each plot of the other varieties.

The trial occupied part of Block XVI. The soil on this block is of the best on the Experiment Farm, and of the most even in character; it was in good heart. The previous crop was barley, which had been eaten off by sheep.

For this experiment the block was subdivided lengthways into four sections—A, B, C, and D, which were 1¼ chain long. The plots occupied by "White Italian" were three drills wide; those of the other varieties were four drills wide. The drills were 3 feet apart, and were 1¼ chain long—*i.e.*, the length of the section.

Section A was devoted to comparison of "White Italian" and "Long Brush Evergreen." Section B was devoted to a comparison of "White Italian" and "California Golden." Section C was devoted to a comparison of "White Italian" and "Improved Dwarf Evergreen."

The seed was sown by the Farmer's Friend maize drill on November 24, 1903. In order to secure a good stand, a liberal amount of seed (6 lb.) per acre was planted. Owing to the favourable weather which followed the planting, the seed germinated well and grew rapidly. On January 4 and 5, 1904, the plants were thinned out to 4 inches apart in the drill. During the growing period the ground between the drills was horse-hoed to minimise evaporation and keep down weeds.

No fertiliser was used with this crop. The weather up to the time the crop was thinned was exceptionally favourable for its growth, but just after thinning a hot wave set in and continued almost until harvest time. This checked the growth considerably, and probably lessened the yields.

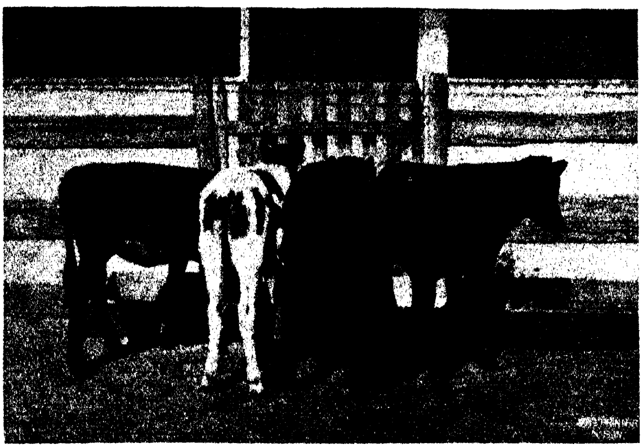
Calves fed on "A" ration.

8 oz. pollard

4 oz. copra cake

2 oz. molasses

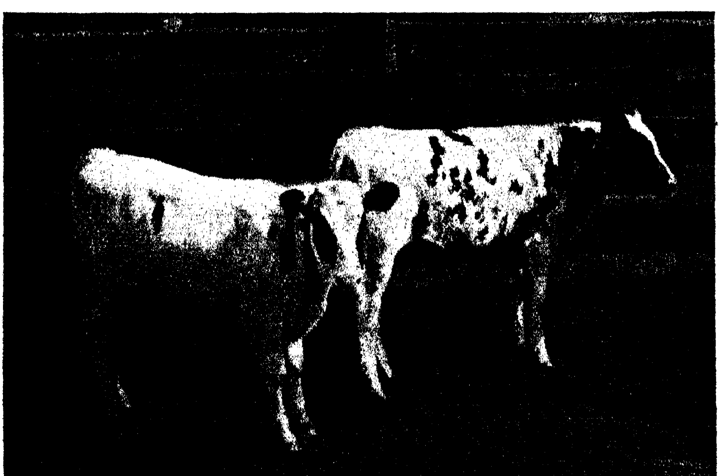
3 galls. skim milk a day (each).



Calves fed on "B" ration.

2 fluid ounces cod-liver oil

2 gallons skimmed milk a day (each).



Calves fed on pure milk.

A Comparative Test in Feeding Calves at Hawkesbury Agricultural College.

(See "Gazette" for May, page 489.)

"California Golden" was the first to break into ear on February 8, 1904. A week later the others showed signs of heading almost simultaneously. All the varieties were ready to harvest within three or four days of each other. "California Golden" was cut first, on March 7, 1904; at this time the grain was well formed.

In order that no influences, other than those which would obtain in a large area grown under similar conditions, should affect the results from which the comparisons were to be made, only the brush from the middle portion, 1 chain long, of the centre drill or drills of each plot was cut, dried, hackled, and weighed.

Before weighing, the brush was graded in various lengths. In each grade the butt attached to the brush was cut to an equal length. The longest brush had about 3 inches of stalk attached; the shortest about 7 inches. Crooked brush was placed with the shortest length or lowest grade. The results obtained are as follows:—

A COMPARATIVE Trial of four varieties of Broom Millets. Tabulated results.

Plot No.	Drill No.	Variety.	Length of Brush, in inches. Over 19.	19.	Between 17 and 19.	Between 15 and 17.	Below 15.
			lb. oz.	lb. oz.	lb. oz.	lb. oz.	lb. oz.
A 1 ..	A 26 ..	White Italian	1 12¾	1 10	0 6¾	0 4¼	0 11½
A 2 ..	A 29 and 30	Long Brush Evergreen ..	1 8¾	1 10	1 9¾	1 11	1 4½
A 3 ..	A 33 ..	White Italian	1 3¾	2 8	0 13¼	0 1¾	0 2
A 4 ..	A 36 and 37	Long Brush Evergreen ..	1 1¾	2 11	2 6	1 4½	0 5¾
A 5 ..	A 40 ..	White Italian	0 13	0 13½	1 3	0 15	0 4¾
B 1 ..	B 26 ..	White Italian	1 2¼	1 12	0 7¼	0 11¼	0 2¾
B 2 ..	B 29 and 30	California Golden	0 1¼	0 5¼	0 9	1 9	1 15½
B 3 ..	B 33 ..	White Italian	0 11¼	0 11	1 3¼	0 7¾	0 5¾
B 4 ..	B 36 and 37	California Golden	Nil.	0 3	1 1¼	1 15¾	2 4¼
B 5 ..	B 40 ..	White Italian	1 0½	1 5¼	0 9¾	0 12	0 7
C 1 ..	C 26 ..	White Italian	1 7	1 2	0 11¼	0 7¼	0 4¼
C 2 ..	C 29 and 30	Improved Dwarf Evergreen ..	0 8¾	1 2¼	1 13½	2 3¾	0 15½
C 3 ..	C 33 ..	White Italian	0 11¼	1 6	0 14	0 5¼	0 4½
C 4 ..	C 36 and 37	Improved Dwarf Evergreen ..	0 14½	1 4½	1 7¾	1 4½	1 2¾
C 5 ..	C 40 ..	White Italian	0 13¾	1 13	0 11	0 10½	0 1¾

In the following table the foregoing results have been averaged, and from them the returns per acre computed:—

TABLE II.

AVERAGE computed yield per acre. Only those varieties grown in same series of plots are comparable.

Plot Nos.	Variety.	Length of Brush in inches. Over 19.	19.	Between 17 and 19	Between 15 and 17.	Below 15.	Total yield of all grades.
		c. q. lb.	c. q. lb.	c. q. lb.	c. q. lb.	c. q. lb.	c. q. lb.
A 1, 3, and 5	White Italian	2 3 20	3 0 27	1 2 11	0 3 17	0 2 26	9 1 12
A 2 and 4 ..	Long Brush Evergreen ..	0 2 13	2 0 13	1 3 24	1 3 24	0 3 6	8 0 13
B 1, 3, and 5	White Italian	1 3 14	2 1 23	1 1 25	1 1 1	0 2 13	7 2 20
B 2 and 4 ..	California Golden.. ..	0 0 5	0 1 0	0 3 5	1 3 0	2 0 9	4 3 19
C 1, 3, and 5	White Italian	1 3 24	2 3 8	1 1 25	0 3 26	0 1 20	7 2 19
C 2 and 4 ..	Improved Dwarf Evergreen.	0 2 24	1 0 17	1 2 14	1 2 24	1 0 5	6 1 1

A study of the results shows conclusively that in this district, and probably in this State, the variety White Italian is the most suitable to grow. Not only is the gross return per acre greater than that of the others, but it produces the largest weight of the longest and best grades of brush. The quality of the brush is also good and very even. This can also be said of the variety Long Brush Evergreen. The other varieties are not equal to White Italian and Long Brush Evergreen in quality or evenness.

HAWKESBURY DISTRICT FARM NOTES.—JUNE.

H. W. POTTS.

THE season has been rendered late owing to the continued rainfall, and, in consequence, the crops are backward. As a rule, the main crops have been sown, but a great deal remains to be done this month where it is possible to get on to the land.

The remainder of the land intended for the growth of wheat, rye, and oats may be sown this month. Algerian oats have, undoubtedly, proved the best in this district. It is a hardy and robust variety, which provides a rapidly-growing crop with a small development of flag, quickly maturing, and practically rust-resistant. It makes an excellent hay.

In some cases the crops sown are fairly well advanced, and where they have the advantage of growing on rich land it will be advisable to feed them down to check them from growing too rank.

The mild autumn, with such abundant moisture as we are now experiencing, provides all the conditions for the early and vigorous growth of plant life. Where weeds or other objectionable growth appears, it will be necessary to cultivate where the crops are drilled and to harrow where broadcasted.

Barley and vetches may continue to be sown this month in the ordinary succession of green forage crops for the dairy cattle.

A further sowing of rape, Dwarf Essex, may be made also.

It will be advisable to sow crimson clover (*Trifolium incarnatum*) where it is required for the purposes of rotation. This annual furnishes excellent green feed for horses, cattle, sheep, and pigs. It prefers a soil of a clayey character, and does better in this than sandy loams, unless where kept very moist. The land should be fairly clean and well cultivated to give the crop a good chance of vigorous growth. As a soil renovator it may be classed amongst the best of the clovers. Its special feature is to provide nitrogen as well as humus for fertilizers for a succeeding crop of cereals. It may be classed as one of the most serviceable of the catch crops.

The opportunity should be taken now to get the required quantity of land under cultivation and in good order for maize, potatoes, &c.

Where it is intended to utilise farmyard manure it should be ploughed in early in order to have it well rotted before planting.

Turnips, swedes, field cabbage, kale, kohl rabbi—these are now coming forward rapidly and should have attention. To thin and cultivate sufficiently to encourage good growth is the aim.

The early crops of rape may be fed off or cut before it is too far advanced so as to enable it to make a quicker and stronger second growth.

Field peas should be largely sown this month.

Sweet potatoes should be dug and stored.

THE DIPPING OF SEED-WHEAT, OATS, BARLEY, &c., IN FORMALIN.

IN order to kill rust spores on seed-grain without damaging it a great number of chemicals have been tried. Among these sulphate of copper has had the preference for a long period. It has been very useful, although many agriculturists have fancied that it damaged the grain itself and hindered its fertility.

Many years ago the manager of the experimental station for combating grain diseases at Halle (Dr. Hollrung) proposed to make use of formalin for the purpose, and after a long series of experiments with this disinfectant he recommended it strongly as being the best. The seed-wheat, barley, or oats, should be thoroughly well moistened with the formalin (a 40 per cent. solution of formaldehyde in water). The seed may be sprinkled or placed in it.

Dr. Hollrung recommends the latter as being most effective. When merely sprinkled it frequently happens that some portion of the grains do not get moistened through adhering together, and this he considers the cause of the formalin treatment not being always successful.

The dipping is most easily performed as follows:—The seed is placed in a vessel a good height over the floor, so as to enable the liquid to be drawn off easily by a tap at the bottom of the vessel into another one. The solution is poured over it in such quantities that the mass of seed can be stirred about with wooden shovels so thoroughly that no air bubbles rise to the surface. The seed is left for ten minutes in the solution, which is then drawn off. The seed is placed in a heap and covered with sacks to prevent it drying for not less than seven hours. It is afterwards dried, and this can be done very quickly, as the grains will have absorbed very little moisture. The work can be done both quickly and easily by using a set of dipping vessels which are filled, stirred, and emptied in succession.

Every cwt. of seed requires about 10 gallons of formalin solution, which, however, can be used over again. The solution should differ slightly for different kinds of grain. For wheat and barley $2\frac{1}{5}$ lb. of formalin in 50 gallons of water. For oats $2\frac{1}{5}$ lb. to 70 gallons of water. All floors, sacks, vessels, &c., used should be carefully cleaned with formalin to prevent any reappearance of the spores.—H. DANNFELT, *Royal Swedish Agricultural Gazette.*

Farm Notes.

BATHURST DISTRICT.—June.

R. W. PEACOCK.

Wheats.—The sowing of the wheats by this time should be completed, and the earlier sown crops may need rolling and harrowing. It is preferable to harrow after the roller, or otherwise moisture may be lost, the loosened surface acting as a soil mulch; the smooth surface left by the roller is also more apt to crust after rains. Whenever heavy rains consolidate the surface, harrowing the growing crops with harrows in good working order will be beneficial.

Oats.—These can be sown largely during the month. May is the better month to sow, especially when grain is required. Owing to the summer being mostly dry, the earlier maturing varieties give the best results. Algerian is one of the best all-round varieties to sow. Of the white oats, Peerless White Bonanza, Carter's Royal Cluster, and Abundance have proved good varieties.

Barleys may still be sown, but it is preferable to have had them in before. Ryes may also be sown.

Onions.—The land should be thoroughly prepared for the reception of seedlings, and every effort taken to keep down weeds. The main crops of potato and tree onions should be planted.

Peas and Broad Beans.—Successive plantings of these should be continued, this being one of the best months for sowing.

Rhubarb.—Roots could be planted out, and, where necessary, old roots could be lifted and divided.

Cabbage, &c.—Small sowings of cabbage, Brussels sprouts, silver beet, red beet, lettuce, radishes, and turnips can be made.

The land for spring crops should not be forgotten, and, if ploughed, many weeds would be killed, and the land brought into condition for spring planting.

Farm-yard manure should be carted out and distributed whenever time can be snatched for the operation.

RIVERINA DISTRICT.—June.

G. M. McKEOWN.

Wheat.—As the rainfall has been insufficient for extensive operations in wheat sowing, much of the sowing will perforce be late, and unless especially favourable conditions set in it will be better to cease sowing by about the third week in the month. Under all circum-

stances it is advisable to drill in about 60 lb. superphosphate with the seed, and under existing conditions no seed should be sown without it.

Barley.—Cape and skinless varieties may still be sown for green fodder in land well prepared and manured.

Peas.—The last sowing should be made as early in the month as possible. Yorkshire Hero will be found one of the best varieties. Growing crops should be kept well cultivated by means of horse or hand hoes.

Vegetables.—Sow a little carrot, parsnip, radish, lettuce, broad beans, and early white turnips. Transplant cabbage and cauliflower, supplying water as liberally as conditions will admit.

Agricultural Shows.

Much has been lately said and written *re* the above, pointing out that they are not up to the standard, and fail to effect the purposes for which they are held. I quite agree with much that has been stated. None of the Shows are as representative as they should be ; only a few, comparatively, take the trouble to exhibit; but little improvement is made from year to year; and, placed beside the great labour and expense entailed, their effect in improved cultivation or bringing out superior products is small indeed. Many little country Shows are merely a holiday and annual gathering of the people in the particular district. In too many instances the prizes are not sufficient. There is a deal of labour in preparing an exhibit of fruit and vegetables, the prizes for which are much smaller than for stock, &c. We need more liberal prizes, and a different system altogether, if we are to encourage new varieties and new methods, and teach our producers how and what to grow. In the shape of products from the soil our Royal Show, at Sydney, is a failure compared with the size of our State and the large number of growers. Having been single judge at four or five Shows annually, for years, I claim to know a little about the matter, and consider that only "single" judging should be adopted, that judges should enter in their book their reasons for any decision likely to be misunderstood, and that all judges should be thoroughly practical men, given free passes, and paid for their trouble. I often act in three or four sections at a Show in the country, and many others could do the same to save Societies the expense of a judge for each section. The life of a Show depends largely on the judge, and I know many Shows have been crippled, and the number of exhibits and exhibition reduced, through bad judging. We need a staff of examined certified competent men and women, too, in the various sections, and their names published in the *Agricultural Gazette*, or a list sent to every Society; and with better prizes, new methods, and good judges we would make our Shows the educational power and benefit for which they are intended.—A. Lansdowne, Goulburn.

Orchard Notes.

W. J. ALLEN.

June.

In large deciduous orchards, pruning may be commenced early this month; otherwise there is no hurry until the end of this month or the beginning of next. This important work should not be neglected if the grower hopes to make the trees produce the most profitable crops. Judicious summer pruning, combined with proper winter pruning, will repay the grower handsomely for the labour incurred; and, while on the topic of pruning, let me again urge growers to head their trees well back at time of planting, so that the tree will carry its fruit from the base to the tips of the branches.

Many of our apple growers suffered severely from apple scab last year. If those varieties which showed signs of this disease last year were given a little more attention, much of the loss caused by it might have been avoided; and, although it is rather early to speak about treating the trees for this disease, I would like to see those growers who suffered making proper arrangements to prevent a recurrence of the trouble this coming season.

Trees so affected must be thoroughly sprayed with Bordeaux mixture (winter strength) just when the buds are swelling; again as soon as the fruit is set, with a weaker solution of the same spray, to which has been added either Paris green or arsenite of soda. In a later number of the *Gazette* I will explain how to mix and apply the solution, and I trust that our growers will go in for more thorough and systematic spraying and manuring of their apple and pear orchards. Such a course would well repay them for their trouble.

I do not think there is a State where more attention is required to keep codlin moth and scale in check, and I think I am safe in saying that in no other State is greater apathy shown for the fighting of these pests. There is no reason why we should import annually from five hundred to six hundred thousand cases of green fruit if growers would grow good fruits and give them proper attention, but up to the present they have completely failed to fill the orders required by the local trade. I still maintain that we can grow fruit of as good quality for local markets or export purposes as can be grown in Australia, and I think that all those who have seen and tasted the apples growing at our Bathurst orchard will bear testimony to this fact.

Care must be exercised not to allow the trees to become too thick in the centre, else the fruit will not colour up as it should. It is only well-coloured fruit that finds the most ready sale at high prices, either locally or abroad.

The lemon crop is fairly good this year, and several growers have expressed their intention of trying to cure a portion of the crop. In my June, 1903, "Orchard Notes" I explained how to pick and handle

them. My experience has been that a cool dry room is the best place to store the fruit. The attention of lemon growers is specially called to the note on the curing of lemons on page 598 of this issue.

Many of the orchards would be greatly benefited by an application of lime, and this is a very good time to apply same, so that it will have had time to act on the soil before the spring manuring.

In frosty places, young citrus trees should be covered without delay, if the work has not already been done.

It is not imperative that cultivation should be carried on in the orchard this month.

In most districts this has been a favourable season for the growth of green manure in the orchard. At our Bathurst and Richmond orchards the tares are already up a good height, but at Wagga the season has been so dry that so far they have hardly made a start.

Turkestan Lucerne.

Mr. W. J. Spillman, agristologist to the United States Department of Agriculture, referring to the trial of Turkestan lucerne, seed of which was a couple of seasons ago introduced and distributed throughout the hottest and the coldest sections of the United States, says that so far as present indications go, it would appear that this variety of lucerne does not appear to possess any superiority to the common lucerne as a drought-resister, and only in some isolated cases has it been found to be specially resistant to intense frosts.

In a recent number of the *Pastoralists' Review*, reference is made to the trial of lucerne of the Turkestan variety by Mr. Edwards, of Burnima, Monaro district. There it has been found to be a valuable plant capable of resisting the extreme cold of the Monaro district.

The United States agristologist mentions that in some unaccountable way the seed from various parts of Turkestan became mixed, so that it is not possible, in arriving at the American results, to make any definite determination as to which particular kind of Turkestan lucerne is to be recommended for either hot or cold situations.

Further supplies of seed have been obtained for trial at the Departmental experiment stations. Until some definite results are available, the agristologist advises American farmers and ranchmen to proceed cautiously with this lucerne.

At Bathurst Experimental Farm, Mr. Peacock has tried Turkestan lucerne (variety—*Medicago Turkestanica*), but so far has not found it to be in any way superior to the upright lucerne, *Medicago sativa*. Mr. Peacock also tried a variety—*Medicago media,* introduced from France. This variety was not found to possess any advantages over the common kind. Reports from Algeria refer to a variety of lucerne largely grown there which is extremely drought-resistant, but it is quite possible that it is merely the offspring of the *Medicago sativa* of Spain and Southern Europe which, under the name *alfalfa,* found its way to the Spanish colonies in America, and in some districts there became acclimatised under the droughtiest conditions.

Practical Vegetable and Flower Growing.

W. S. CAMPBELL.

Directions for the Month of June.

Vegetables.

At the time of writing—the middle of May—the weather is so mild that there seems to be a good prospect of mild weather during the early part of June, at any rate, instead of the cold, bleak weather generally experienced during that month. Many varieties of vegetables which are generally defunct at the time of writing are growing well, as is the case with Mr. Ellis's French beans and potatoes, referred to in another part of the *Gazette*; but it would be folly to chance planting seeds of these vegetables, except in localities such as the eastern part of the Clarence and Richmond districts, where frosts seldom cause damage to either French beans, potatoes, tomatoes, or other tender vegetables.

Rainfall has been highly satisfactory in many parts of the State, and fairly so in others. But, unfortunately, there are certain huge patches still very dry, and where, without a good supply of water, the growing of a few vegetables becomes a difficult matter; but when one hears of the members of the late expedition towards the South Pole growing mustard and cress in their frozen-up ship, on blankets, in order to obtain a bite of something green, surely there is still hope to grow some kind of vegetable even where a drought prevails.

Get rid of weeds and rubbish, and plant and sow vegetables, just a little at a time. For instance, if a family requires six cabbages a week, plant out eight or ten every week, and this will allow for loss; but, of course, no family would care to continue this same vegetable every day, but the principle or system will be understood by such an illustration. As vegetables are used and cleared away, dig up and manure the places occupied by them as soon as ever you can. In practice you cannot do this exactly—something or other will certainly interfere with this nice little exemplary arrangement. Some fearful wet weather sets in, perhaps; or something gets sick, or the fence gets broken, and all the spare time is occupied with these unexpected odd jobs. However, keep in view the system arranged, and follow it as closely as possible. Carefully avoid the growing of any one kind of vegetable in too great a quantity at one time, which generally results in surfeit or famine.

Globe Artichoke.—May be planted during the month or later still, or during the spring if more convenient; but the sooner it be planted the sooner the grower will enjoy the fruits or, rather, buds of his labour. This is a large-growing, cumbersome vegetable. A single plant, if well grown on rich soil will provide a fairly good supply of

the flower buds, which should be gathered before they expand, and are then boiled and eaten with melted butter, and useful to eat if it be desired to prolong a dinner for a considerable time. Either suckers or rooted plants may be set out, the rooted plants being the most reliable.

Artichoke, Jerusalem.—This is altogether a different thing from the above; a kind of sunflower, the roots or tubers of which are used like potatoes. This is a prolific and capital vegetable which, if grown largely, will be found most useful for pigs, who will perform all necessary harvesting for themselves if allowed access to the plants. In soils suitable, the weight of crop is sometimes enormous. The tubers are ready now for the digging, and may be taken up as required. Retain sufficient tubers for planting out in the spring.

Broad Beans.—This time of year is very suitable for the sowing of the broad bean. The seedlings from sowings made last month should be growing satisfactorily if they have been kept free from weeds and occasionally hoed. A short row planted once a week or once a fortnight should be sufficient of this vegetable. Plant the seed in rows from 3 to 4 feet apart, and about 6 to 8 inches apart in the rows. Cover the seed about 3 or 4 inches deep. Some gardeners sow beans in rows one foot apart, then a space of 3 or 4 feet is left, then a double row again; but perhaps the single row is the most satisfactory. The old Windsor bean is a good variety for general purposes. The dwarf varieties are good, and may be planted much closer than the late-growing kinds.

Cabbage.—There should always be a few seedlings just ready for planting out, or pricking out as they may be required, and this can be arranged by sowing a very little seed, say, twice a month, and pricking out the little seedlings when they are ready, about twice every month also. When the pricked-out plants are ready to shift, they can be moved as required, and, if abundance of manure is used on the ground prepared for them, they should grow rapidly. If you desire good cabbages, be not sparing of good manure, not rank and fresh, but well-rotted dung, and then the cabbages will be tender and sweet and good, especially if the soil between them be frequently hoed.

Endive.—This lettuce-like salad plant is useful for winter use, and is much appreciated by some persons for its peculiar, bitter flavour. A little seed may be sown occasionally, and young endives planted on well-manured soil.

Carrot.—Sow seed of some of the small varieties of this vegetable, for they are likely to succeed the best at the present time. Where cabbages have been growing would be a very suitable place for some carrots, for the soil should be in just the condition for a satisfactory crop of them.

Cauliflower and Broccoli.—These vegetables resemble one another so much that they are frequently both termed cauliflower. The method of culture is practically the same for both and they may very well be bracketed together. Plant out a few young plants in good rich soil, and be careful in the moving, for any check to the growth, such as

breaking many roots, is not advisable. Keep these plants growing all the time, from seed to hearting. Early planted cauliflowers and broccoli should be available for use.

Leek.—Sow a little seed now and then during the month and plant out a few young leeks occasionally. Use abundance of manure when preparing the ground, and use plenty of water should the weather be dry.

Lettuce.—A little seed should be sown occasionally and seedlings planted out from time to time as required. Move them carefully and use abundance of well rotted, not rank, manure.

Onion.—If a sufficiency of plants have not already been raised, some more seed may be sown any time during the month. Keep the young onions well weeded and thin out all that are growing too close together.

Parsnips.—A small quantity of seed may be sown. Well-grown seedlings should be thinned out as they become crowded.

Peas.—Sow about twice during the month as extensively as may be required. Provide supports of some kind—sticks, brushwood, or wire-netting—for the young peas to climb up. Sow the seed about 4 inches apart in rows, and about 3 inches deep. The drills or rows formed may be 2 to 4 feet or more apart according to the height the peas are likely to grow, for some are dwarf, others of medium height, and others, again, grow tall.

Radish.—Sow a little seed two or three times during the month.

Herbs.—Plant out good young plants, or take up old stools, divide them, and plant the best in good fresh soil.

Flowers.

New gardens can be made, and old gardens remade, if necessary, or increased, and many alterations effected at this time of year, but a good deal of care will be necessary when digging about the garden to avoid injuring dormant bulbs, or bulbs which are just making growth below the surface, and there are many kinds now which are just starting to grow.

When making alterations, or when digging and tidying up the flower garden, apply a good deal of well-rotted dung, and mix it in with the soil. All kinds of plants which have cast their leaves may be planted at any time convenient, but before planting examine the roots and remove any that are broken or bruised, using a sharp knife for the purpose. Such plants as carnations, columbines, snapdragons, violets, polyanthus, cowslips, daisies, perennial marguerites, campanulas, foxgloves, pinks, Sweet Williams, delphiniums for gardens in cool climate, stocks, wallflowers, dianthus of varieties, marguerite carnations, everlasting peas, perennial phlox, statice, Japanese anemone, gaillardia, roses, and others may be planted, as well as any hardy annuals which are ready for putting out.

General Notes.

Bacon from the Shopkeeper's and Householder's Point of View.

In Sydney, during the past twelve months and more, the retail price for Victorian cured bacon has been, for the prime cuts in small pieces, as high as 1s. 2d. per lb., for some New Zealand brands as much as 3d. per lb. more, for certain Queensland brands over 1s., and for most of the New South Wales brands considerably under 1s. per lb.

In answer to an inquiry as to why such should be the case the salesman in a leading store said that so far as he could gather from his own extended experience, and from the opinions expressed by regular customers, the New South Wales product, while being upon first cutting equal in many respects to any other bacon, did not suit the requirements of the householder who liked to keep some bacon always at hand for use whenever desired. "Suppose," said he, "you were to buy 3 or 4 lb. of New Zealand or Victorian bacon for use as rashers. In the first place you can fry it or grill it just as you cut it off, without ever bothering to extract some of the salt as in the less mild-cured article. Then, if you hang it up with, as it generally has, three sides exposed to the atmosphere, the best of New Zealand and Victorian will not become in any way 'rusty,' and of course this means considerable saving in the long run."

When we come to realise that it is by encouraging the taste for good bacon the consumption will be most largely and profitably increased, it seems well worth the while of the bacon curers of this State to make careful investigations of the reasons why the grocer always hands to the customer who requires the best bacon and is prepared to pay a big price for it a cut from an imported side. It is well known that there are consumers of bacon who have peculiar prejudices for "gaminess," excessive fat and other qualities, but the requirements of these people are soon met, and the margin of profit to the pig-breeder is not, and will never be as great as it would be in catering for the very considerable high-price local trade, and for the British market where the best quality of bacon is in enormous demand at good prices, and indifferently-cured bacon sells at a price that leaves to the pig-raiser and curer a very small margin.

At the Hawkesbury Agricultural College bacon is made of quality equal to any that can be purchased in the city, which shows that when the breed and feed are right, the curer can turn out the desired article.

The Canadians are making strenuous efforts to secure a big share of the £25,000,000 which is annually spent in the importation of bacon and hams to Great Britain, and they commissioned Professor Robertson to ascertain the actual requirements of British buyers. As the result

of the Commissioner's report, the Dominion Department of Agriculture, in co-operation with the leading bacon-curing establishments, have persistently advocated the adoption of feeding methods and management under which the farmer can turn into the factories by tens of thousands pigs of uniform grade; and, with a carcase so developed as to permit of the production of firm bacon with well-balanced proportions of hard snowy-white fat and bright pink lean.

The ideal has not yet been generally attained among Canadian pig-raisers; but, under their system of large central curing establishments, where the carcases that do not come up to requirements are rigidly excluded, they are so far on the road to successful achievement of their object that New South Wales pig-raisers would not lose any money by taking a leaf from the Canadian book. The results of a good many of the Canadian experiments have been published in this *Gazette* from time to time.

The latest summary of results of a very extensive series of feeding experiments are given as follows by Mr. J. H. Gusdale, of the Ontario Agricultural and Experimental Union:—

Feeding and topping-off pigs too rapidly and marketing before maturity will cause soft bacon.

Maize fed with a small proportion of skim-milk or whey gives much better results than maize only.

A small proportion of maize with oats or barley or with peas does not appear to have an injurious effect. Barley is unsurpassed as a feed for the production of firm bacon. Oats, also, are excellent. Peas produce good results, and mixed with other grains are exceedingly valuable.

In conclusion, skim-milk or whey in the ration are almost infallible guarantees of firm pork. The cereals and peas properly fed constitute an almost faultless ration. Maize may be fed, but must have some counteracting food along with it, or it will give bad results.

So much for the cold climate of Canada. What our pig-farmers in the northern districts require now is to try whether the same thing will suffice for their conditions. If not, the results of some feeding-trials, which need involve little expense or trouble, should soon reveal, in so rapidly-maturing an animal as the pig, what is the ration that will produce, in any particular district, with the greatest certainty and at least expense, the most saleable class of bacon.

TRIALS OF MAIZE IN CAMDEN DISTRICT.

MR. A. J. DOUST, of Werombi, *via* Camden, reports:—The several samples of maize forwarded by you for trial in this district have had an extraordinary season during their growth. From 7th September to 5th October, 1903, all the samples were sown, when cool, sunless weather prevailed, and the maize crops generally stood still, making not the slightest headway. In December last beautiful rain fell, and warm weather followed, when the crops made phenomenal growth. A long, dry spell occurred shortly afterwards, which affected the big grains not of rapid growth. Notwithstanding the peculiar season, nearly all the samples of the early varieties—Early Yellow, Early Abercrombie, Pride of the North, Early Mastodon, Riley's Favourite, and

Ohio Silver Mine—did well, but the Mastodon was the best yielder, and gave more weight to the row than the other varieties. Riley's Favourite is next best. Red Hogan did fairly well. Mr. W. J. Gibson tried some of the early yellow maize and Pride of the North, and showed me some fine samples of same. Mr. Jesse Hayter gave Riley's Favourite and Early Mastodon a trial, and found that both did well. The latter variety did best with him, as it did with me. The Tuscarora flour maize grew successfully and cobbed well. I am satisfied it would pay to grow in this district. The Golden Beauty was the only maize that failed, as it tasselled during a dry spell. The Golden King and Hickory King turned out fine, big grains, but did not grow long cobs. I may add that at the recent Camden Show I secured second prize for the best collection of maize in cob—having nearly all your varieties represented.

The soil in this district is light and not adapted for the growth of large-grain varieties of maize.

Manitoba Wheats.

I sent one of the samples of Manitoba wheat forwarded by your Department last autumn to Mr. L. Williams and another to Mr. W. J. Gibson. The first-named gentleman failed to get his seed sown owing to dry weather, but Mr. Gibson planted his and it came on well. The hares, however, ate the crop down before it grew any height. I tried the purple variety on a piece of land where I had sown some wheat previously that had taken the rust badly. I am pleased to report that the sample turned out successfully. Fine, healthy stalks over 6 feet in height resulted with not the slightest sign of rust. In the spring it seeded well—good, plump grain. For hay purposes, the Manitoba purple wheat would yield 3 tons to the acre. The district here is not adapted for wheat-growing, but occasionally good samples of wheat have been grown. Mr. L. Williams grew a fine crop of wheat, and succeeded in winning first prize at Penrith show with some, and, I believe, first at Camden show.

PIGEON-RAISING FOR MARKET.

THERE is a very fair local demand for pigeons in Sydney for table and other purposes, and it is the sort of demand that would be likely to increase with added facilities of obtaining a large and regular supply of birds. In the United States squab-raising has been worked up into quite a big industry, and it is a remunerative one when skilfully managed. Mr. W. E. Rice, who is one of the most successful of pigeon breeders on a large scale for market in America, says in an article in the *United States Farmers' Bulletin*, No. 177, that the great secret lies in securing the proper sort of stock. Homing pigeons, or carriers as they are more commonly called, and dragoons are regarded as the best breeds, while a cross between the two is favourably mentioned. A large house is better and more economical than several small ones, but in no case should the one house accommodate more than 200 pairs. Pigeons require feed twice a day, the best foods being cracked maize, red wheat (in this State grain from bearded varieties

such as Algerian and Belotourka, which do well in the coastal districts, would be a cheap substitute), Kaffir corn, millet, peas, hemp, and rice. The importance of varying the diet is insisted upon, as well as plenty of pure water for drinking and bathing, and attention to the sanitary condition of the houses, nests, and yards.

Mr. Chambers, of this Department, who has had some experience of breeding pigeons for the domestic table, says that he has found fantails to be the most suitable variety to keep where there is no special provision for pigeons, because while they are the biggest birds, they do not fly about much, and evince little or no desire to roost on roofs. It is, of course, this habit of perching on roofs from which water is gathered that makes the presence of pigeons about a place distasteful to many people, and, therefore, fantails are well worthy of attention. As to their reproductive powers, Mr. Chambers is of opinion that the fantails are equally as prolific as the other breeds.

At the Hawkesbury Agricultural College Poultry Farm there are dozens of pigeons at large. They do not seem to be any trouble, and serve a useful purpose in eating up remnants of food that the fowls do not clean up, and which would, in the absence of pigeons, &c., only serve to encourage sparrows.

Poultry farmers might well add pigeons to their stock, starting in a small way and giving them a fair trial. There may be certain conditions under which the birds would be more nuisance and cost more than they are worth, but under careful management that would not be likely to happen often. When they do succeed, the disposal of a few dozen pairs every now and then at even one shilling a pair would be, in the off seasons for eggs and table poultry, a welcome source of ready cash.

Irrigation from Small Water Supplies.

In the State of Florida, in 1902, there were 405 farms representing a total area of 3,772 acres under irrigation. These farms produced in the year crops to the average value of £86 per acre. The irrigation systems with water obtained from streams, lakes, and non-flowing wells by various pumping devices, or from artesian wells having a strong surface flow, represent a constructive outlay of about £102,000, or about £28 an acre, and an annual cost of about £90,000, averaging about £27 per acre, leaving a balance of nearly £50 per acre net. There were, during the year mentioned, fifty-six farms having an irrigated area of 459 acres, which did not produce crops, the land being planted out with young orange trees. The cost of constructing irrigation systems supplying these fifty-six farms was £13,500. There were also reported twenty-five irrigation plants, costing £5,350, that were not operated in 1902.

The districts in which irrigation is practised are widely scattered. In the north-west of Florida the irrigated areas are devoted to the cultivation of Sumatra tobacco, while in other sections the principal holdings are truck and small fruit farms, orange groves, pineries (pineapples), and nurseries. From this range of crops it will be seen that the areas to which water is applied artificially are within

districts very similar to the north coastal sections of New South Wales. There is, as a matter of fact, no absolute necessity for irrigation—that is, the conditions are never so arid as to render artificial water imperative—but the most progressive farmers find that the less their operations have to depend upon natural rainfall the more even and profitable the output.

Such successful instances as this serve to show what can be done in truck (vegetable) and small fruit-farming in districts where the rainfall although for the twelve months, perhaps, totalling 30 to 40 inches, does no come at the right times for the man who is practising intensive culture. When Mr. Elwood Mead, the chief of the Irrigation Investigations Division of the United States Department of Agriculture, last visited Europe to see what was being done in respect to irrigation in Germany, Switzerland, Italy, and France, he found that in the valley of the Po there was a similarity of conditions to those of many of the sections of the eastern part of the United States. The rainfall of that part of Italy is about 40 inches a year. Mr. Mead found that the Po farmers do not irrigate because they have to, but because it pays. In the greater part of the country the staple crops are maize, wheat, and clover. The fields in which these crops are grown are frequently planted with mulberry trees which furnish food for silkworms. Irrigation increases the yield of mulberry leaves by one-third. It enables a crop of maize to be grown after the wheat crop has been harvested, and doubles the yield of lucerne and clover.

Rice and marcite are grown under irrigation. The latter is grass grown in a meadow kept continually moist by watering, and cut when it is about 15 inches high for feeding dairy cattle. The annual value of this crop reaches in some districts—near Milan, for instance—as much as £60 per acre. Land and water rights in the best marcite districts surpass in price, says Mr. Mead, the fruit lands of Southern California, some of the farms near Milan being held at over £600 an acre, and rights on the canal sell for over £240 an acre. These are maximum prices, and far higher than in the case of land where only wheat and maize can be grown. The minimum prices for land with rights on the ditches in districts lately brought under irrigation are from £33 to £36 an acre. Unirrigated land in the same neighbourhood sells for about £25.

Irrigation from Wells.

It is often asserted that unless a man has a big perennial stream to draw water from, little or nothing can be done in the way of the production of crops on a commercial scale. As an example of what can be done by means of well-water in arid regions, the estate of Captain A. J. Hutchinson, at Lindsay, in Tulare County, California, might be taken. Here, according to the *Home-maker*—an American journal actively devoted to the development of irrigational enterprise—a few years ago, stretched away before the eye miles upon miles of bare land without a building, without a fence. The country was barren, useless, supporting a few herds of domestic sheep, and affording them in normal seasons a barer existence under expensive

management than the most drought-stricken areas to be found in New South Wales in a dry year. To-day there are acres of as fine orange-trees, of as well-worked soil, as plenty of warm sunshine and judicious supplies of water can produce. And every drop of water has to be pumped from the earth. The 30-horse-power engine of the Lindsay Land Company pumps 51,000 gallons of water per hour, and there are numerous other individual pumps. A most interesting thing about this development is that the power to do this pumping is transmitted from miles away in the mountains where water of another irrigating system, before it is used on the land, generates electric power to run street cars, light streets, and pump well-water for the irrigation of 3,000 to 4,000 acres of orchards. Captain Hutchinson, who lost his health in the British army in India, sought California to find relief. He came to the Lindsay district with the view of bringing water down from the mountains by means of an open ditch. Such difficulty was experienced that he determined to prospect for water below the arid surface. He found it, and the first large well which was sunk struck a fine flow at 80 feet depth. From this well Captain Hutchinson irrigates a 20-acre orange orchard, and the writer of the article, from which these notes are taken, states that the sight of this flourishing plantation of magnificent trees laden with fruit, in the midst of a brown and scarred desert, is one that cannot easily be forgotten.

If such things can be done in California, and especially in such districts as Lindsay, where during the cold spells of winter, the thermometer goes down to 20 degrees below zero, and thus adding disastrous frosts to the disadvantages of inadequate rainfall and expensive pumping, surely much might be achieved in New South Wales where, first, water is cheaper and more easily obtained; and, secondly, frosts seldom are sufficiently severe to constitute a perpetual menace and source of expense for protection.

The Apple in Cold Storage.

The application of cold storage temperatures to the preservation of fruits has profoundly influenced the development of American fruit-growing. When orchard products had to be transported to market in common freight cars and express cars, or by boats running on slow schedules, and the surplus fruit was stored in cellars, pits, and fruit-houses without artificial cooling, it was necessary to dispose of the crop quickly in local markets to prevent unusual losses from decay. Even under the most favourable conditions, the markets were often over-supplied in the fall months, with an accompanying demoralised condition in the fruit trade, especially when the weather was hot, while the supply of small fruit was exhausted early in the winter, and the markets were barren during the remaining season. The development of the fruit refrigerator-car service and other improved methods of transportation have made fruit-growing possible in remote parts of the country, and have facilitated the wide distribution of the most perishable products. Mechanical refrigeration on shipboard and the introduction of other special facilities for fruit transportation are extending

the markets for fresh fruit abroad. The growth of cold-storage warehousing business is making the season of fresh fruits and vegetables perennial. It is distributing them more uniformly throughout the season, and is thereby contributing to their freer use, to more steady markets and uniform prices, and to a more stable fruit business. Cold storage is having an important influence in developing the apple industry as a stable business. Instead of an incidental feature of the general farm, the apple is now the principal crop in large sections of the country, and its production, and the handling and marketing of the crop, are becoming highly specialised forms of agriculture and of trade. Formerly the marketing of the crop was largely controlled by the apple grower, but now the growing of the crop and its sale are rapidly differentiating into two distinct lines. In many of the principal fruit-growing districts the handling of the crop and its marketing are controlled largely by fruit organisations or by apple merchants, who buy the fruit in the orchards, and who, through the special development of fruit and market statistics, are better able than the fruit-grower te regulate the distribution and sale. This greater stability and specialising in apple-growing is accompanied by a large amount of speculation. Through a combination of the buyers, the fruit may not always sell in the orchard for its real value; but, on the other hand, the severe competition in buying in those sections, where the industry is especially well developed, frequently brings the grower the highest prices. Apple storage is not always profitable. It is an insurance against the premature deterioration of the fruit, but when the picking season is unusually hot, and there are delays in getting the fruit into storage, the subsequent losses are sometimes very heavy. On the other hand, the autumn may be unusually cool and favourable for storing large quantities of apples in common storage. As a result, the markets are well supplied with this fruit through the winter, causing the cold storage stock to be held back till late in the season, when it has to be rushed on the market and sold as a sacrifice on account of the approaching warm weather and the free use of southern early fruits. On the whole, the development of the cold storage business is proving beneficial to the apple industry in encouraging the development of apple-growing over large territories, in making the investment of capital safer, in developing it as a highly specialised type of agriculture and trade, and in making a valuable food product available to an increasing number of people over a greater part of the year. The magnitude of the cold storage warehousing business and its importance to the fruit industry are not generally recognised. Accurate statistics are difficult to obtain, but in 1901 it was estimated that the capacity of the cold storage warehouses—including meat, eggs, and butter storage—was 150,000,000 cubic feet of space, of which 50,000,000 cubic feet, distributed in 600 houses, were devoted to fruit storage. Since 1901 there has been a large increase in the number of fruit storage houses, especially in the apple-growing districts, where many plants, with a capacity of 5,000 to 30,000 barrels, have been erected in or near the orchards or at the railroad stations.—Bulletin, Department of Agriculture, Washington, U.S.A.

Here in New South Wales we scarcely have touched the fringe of possibilities in the apple-growing for export. The quality of the fruit that can be grown in the cooler districts is equal to that produced anywhere, and before long there will be the results of the trial shipments now being made with apples grown at the Bathurst Orchard to determine the carrying qualities of several of the most promising kinds. The great handicap to development of a large export and storage trade in apples at present is the enormous number of varieties grown. Instead of endeavouring to ascertain what are the best commercial apples for his particular locality and sticking to those few varieties, nearly every grower has an endless variety, and thus it is difficult to gain for the fruit any recognition in markets where large quantities of a few special kinds are required.

Meanwhile there does not appear to be any reason why some sort of an effort should not be made to cold store a few lots of well-selected fruit with the object of having local produce available at the time when we have to pay 2d. or 3d. apiece for imported fruit of inferior flavour.

Talking about markets for fruit, would it not be worth the while of growers to exploit some of the new markets. For instance, Mr. Henry B. Miller, United States Consul at Nuechwang, China, says:—"California ships a quantity of third grade yellow Newtown pippins to China, some of which are consumed by foreigners, but most of them go to the Chinese fruit stands and restaurants, and are eaten by the natives. The Chinese appetite for fresh fruit is very strong, and apples are in great favor, the only obstacle to the creation of a large market is the inability of the masses to purchase. The average Chinaman does not distinguish the different varieties of apples, and if inferior grades could be sent at low rates an extensive outlet could be created. Northern routes are the best for shipping green fruits. All shipments of apples for the northern ports of China should be sent by October 1, on account of the danger of freezing if they arrive late in the season. If the fruit reaches north China in good condition it it will keep well on account of the dry, cold climate."

EDUCATION IN THE SHOW RING.—JUDGES GIVING REASONS FOR THEIR DECISIONS AT P. AND A. SHOWS.

WHEN the Governments of the colonies (now States) first began to subsidise Agricultural Societies or Associations it was under the belief that they would become valuable educational factors, and the Shows be gatherings whereat the people who settle on the land and gain their living from the soil would learn to distinguish between right and wrong—what they should produce and what they should not, what they wanted for their advantage and what they did not want. But has this ideal been fulfilled? It is feared not. The great objects of these societies seem to be largely lost sight of, and little or no effort is made to carry out the object for which they are subsidised. These societies receive some £10,000 a year of the taxpayers' money, with the understanding that they use every effort to be educational.

One step in this direction that is within the reach of every society, and entails little or no trouble, is the making public the reasons for judges' decisions, thus conveying broadcast to the masses knowledge that it has perhaps taken the judge a lifetime to obtain and perfect. There was never yet a judge that deserved to be called one who could not, if he wished, say in a few plain words why he considered the exhibit he was awarding the prize to superior to the second best. This reason being plainly written on a card, is placed alongside the exhibit, and in this simple practical way, with the best judges that can be got as teachers and the exhibits as object lessons, much can be taught, particularly to the young beginner.

People have been going to Shows for years upon years, gazing with puzzled eyes upon animals or articles, the while wondering why one was decorated with a blue ribbon or a red, with first or second cards, and something else was cast into oblivion altogether. They see a dozen horses brought into the ring, a blue ribbon put on one and a red on another, and the lot turned out, and another class brought in. But how little the spectators learn from this. They leave the ground no wiser than when they came. The man who has been reared among stock and has a perfect knowledge of same can see the reason for the judge's decisions; but a large majority of the spectators anxious for information cannot, no opportunity being offered to the public to learn even why the first is superior to the second, which is usually the great point in dispute. Needless to say, a judge is not asked to give his reasons against the losers. If a man sends an inferior or blemished horse to the Show it is thrown out, but the judge does not give his reasons for that. All the judge is requested to do is to give the reasons why the prize winners are placed as they are. He damns no man's cattle. A good stallion is often placed second because he is not as good as the first in one small trifling point. But the public do not know this, and they only learn the broad fact that the horse has been placed second, and the owner has to take his defeat and the depreciation of his horse in silence. No opportunity is given the judge to point out that the horses were almost equal. It will be thus seen that in such cases the judges giving their reasons is a great help to the defeated exhibitor. The method does not increase the annoyance or disappointment of being defeated—quite the reverse. The explanation tends to pacify. That the system helps to keep back incompetent judges from acting goes without saying, and hence does much good in improving the quality of our judging. It also removes the possibility of favouritism. Of course, like all new proposals being put in practice, never mind how good they are, nothing but practical experience will show which is the best way to carry them out. But if at first defects are discovered in the method of working, that does not prove that the system is not an excellent and very desirable one. Like all systems of reform, the method has its critics, but even they must admit it is a step in the right direction, and should commend itself to all who take an interest in the working of our Pastoral and Agricultural Associations.—R. T. KEYS, Muswellbrook.

CURING THE LEMON.

IN this State, where so many lemons are grown, and where the fruit does so well, it would be of great advantage if the growers, in place of marketing their fruit when the market is poor, could store it until the hot weather, when the demand is always good for cured fruit. It has been the custom here to pick the fruit one day and market it the next, without any attempt at improving its condition by keeping it for a few weeks or months, according to local conditions.

By keeping the lemons exposed in a fairly warm room for a few weeks after picking, their condition can always be considerably improved—that is, the skins become thinner and more pliable, while the quantity of juice is greatly increased and is more readily extracted. Of course, if it is desired to keep the fruit a long time, it would not do to expose it in this way, as for this purpose a slower process of curing is required, and for this reason the fruit must be picked and stored away while it is almost green, and not later than when it shows the first signs of ripening.

It must be borne in mind that an over-ripe lemon will not keep for any length of time; but lemons which have been allowed to hang on the tree until they are over-ripe, oversized, and thick-skinned, may be greatly improved by picking them carefully and keeping them for a few weeks, as above described, before marketing them.

There are occasional seasons when the lemon crop is exceptionally heavy, and it is during these seasons that growers will derive the greatest benefit if they can succeed in storing their fruit in such a manner as to enable them to keep it until the warm summer months.

Before coming to this State I have successfully stored and kept thousands of cases of lemons each year for periods ranging from three to six months, and these were sold eventually at about three times the price that they would have brought at the time of picking or early in the season.

The imported lemons usually command double the price of our own, simply because they are in better condition, as owing to their being picked green, stored for a few weeks, and sent here, they will keep for a good while even in our hot weather, while our own, which are taken straight from the trees to the market, will only last a week or so before many of them show signs of going bad. This latter condition is often brought about by rough handling, when the fruit becomes badly bruised, and consequently will not keep.

So far as the quality of our lemons is concerned, I have never heard a complaint. As a matter of fact, I think we can grow fruit of as good quality as any other country; but as most of our fruits are grown in a moist and rather humid climate, it will be found a little more difficult to store them for long keeping than in our warmer, drier districts, such as Moree, Dubbo, Wentworth, Bourke, &c.

The building which I used for the purpose of storing and curing the lemons was a large one, with plenty of ventilation. It had wooden sides and an iron roof, and served to keep the sun's rays from

the fruit, and could be kept fairly dark. In this building I used to keep the fruit for several months, using ordinary sweat-boxes, which held about three ordinary cases of fruit. After filling these cases, I stacked them up one on top of the other until I had about 500 cases in a stack; then around the outside of this stack I hung bags, and covered the top with bags and trays, and in this way succeeded in keeping them with very little loss. Of course, I examined the fruit about every six weeks, and removed any which showed signs of decay. The temperature in the building during the latter part of the process often reached 80 degrees. I found that in every instance where a current of air could penetrate to the fruit it would cause it to wilt, and in time become too dry and hard; hence I hung the bags around the outsides of the cases to avoid this as far as possible.

The *California Fruitgrower* of 11th July, 1903, gives Mr. C. C. Teague's process of curing lemons, which sounds deserving of a trial, as thousands of cases are now being cured in this way in California and shipped to the Eastern States during the summer months without the use of ice, and with better results than when the shippers depended so largely upon its use in the refrigerating cars and refrigerating chambers in the Eastern States, as it is stated that the fruit will not keep long after it is removed from the cold chambers.

The following is the Teague process as published in the above-named journal:—"The past year marked one of the greatest, if not the greatest, strides that has been taken in the lemon business since the shipping of lemons from California has assumed anything like commercial proportions; a stride that has been a complete revolution of old methods, and one that is destined to have a far-reaching effect upon the future of the business. I refer to the open-air method, as it has been termed, of holding and curing lemons. Unfortunately about 75 per cent. of our lemons are gathered in the winter and spring months, and up to last year the experience of our growers and shippers who had attempted to hold their fruit until the summer months had been so disastrous, on account of the heavy decay, that they had concluded that the most profitable way was to ship the fruit within from four to six weeks after gathering. The result was that the fruit was not equably distributed throughout the year, and at times the market would be so glutted that the shipper would get 'red ink' for his shipment. Not being able to hold his lemons when the market was low, and having only the smaller percentage of his crop in the summer, when the price is usually high, one can, perhaps, imagine how the lemon-growers' books have been balancing at the end of the year, and will probably be able to answer the question often asked: Why are so many lemon groves being budded over to oranges?

"Styles of Packing-houses.

"The old style lemon-house, and the one still used by many of our groves, is a double-walled, double-roofed affair, some of them having patent systems of ventilation and others depending simply upon doors and windows. When attempting to hold lemons by this method, they

are massed in the house and the fruit just clipped given exactly the same ventilation as that which has been in the house several months, when, as a matter of fact, lemons in different stages of curing require radically different treatment as regards ventilation. As a result of this treatment some of the fruit is usually wilted from receiving too much air, while the greater portion of it is badly decayed from receiving too little.

"Proper ventilation is the keynote of success in keeping lemons, and, after extensive and expensive experience along the old lines, I assert that it is entirely impracticable to hold lemons in large quantities, for any great length of time, by the old method. We have all been on the wrong track in believing a low temperature first in importance. If the ventilation is right the temperature will take care of itself. I have always said that the proper keeping point for lemons is just that point between where they will wilt and where they will sweat.

"The Limoneira Company of Santa Paula was the first to equip a house on the open-air plan, and as that Company has the most extensive plant and the widest experience in this method, perhaps a description of its lemon-house and its method may be of interest.

"The Method of packing.

"To begin with, the lemons are very carefully gathered, great care being taken in handling so as not to bruise the fruit. Rings of $2\frac{5}{16}$ inches diameter are used for winter pickings and $2\frac{1}{4}$ inches diameter for spring and summer, never more than six weeks being allowed to elapse between clippings, and the fruit is usually gathered about once a month. By careful attention to this, desirable sizes and good keeping stock are obtained. I want to say right here that this is the weak point of over 90 per cent. of the lemon-growers of California. I have just returned from a tour of the principal lemon-growing sections of the State, and I found, as I have always found, that the carelessness with which clipping is done is almost criminal. In grove after grove which I visited at least 50 per cent. of the value had been lost by allowing the fruit to hang on the tree too long. Not only on account of large sizes would it have to be discounted 50 per cent. per box, but the keeping quality of the lemon which is allowed to mature on the tree is never good. Good results cannot be attained, even by the best methods of keeping lemons, unless the fruit is picked at the proper time and carefully handled. A little illustration will, perhaps, be in point.

"Some time ago I visited one of the Southern California packing-houses, and they happened to be getting out a car of lemons at the time. I noted the rough, careless manner with which the fruit was being handled, and spoke to the manager about it, remarking that our fruit would not stand that kind of treatment, and asked him if he did not have trouble with decay. His reply was that they had practically no decay, and that their fruit was giving fine satisfaction. Before leaving I took note of the car number, and watched it in my bulletin. When the car arrived east, 25 per cent. decay was reported.

"The Packing-house.

"The Limoneira Company's house is 300 x 100 feet. The flooring is 2-inch planking, and the roof covered with gravel-paper roofing. The building has no sides whatever, allowing free circulation of air. The fruit for storage is put into regular shipping boxes, piled in blocks of 560 boxes. There is a double row of these blocks on either side of a 20-foot space, which extends the entire length of the building and which answers the double purpose of a workroom and an air space. The boxes are so piled as to permit of the circulation of air around each box. Each block of fruit is covered with a canvas 10 x 10 x 20 feet, made box shape and open at the four corners. The ventilation is controlled by the raising or lowering of this canvas, and each block of fruit can be given exactly the ventilation that it requires, irrespective of the other fruit in the house. By this method fifty or even 100 cars of fruit can be handled and kept in as good condition as if there was only one. Each block being numbered, a complete record of the lemons from each of the six sections of the ranch is kept from the time it is gathered until shipped. The fruit is all washed in a lemon-washing machine, and is piled up in the house, wet, just as it comes from the machine. The canvas covers are not dropped over it, however, until it is thoroughly dry.

"The Limoneira Company handled over 100 cars by this method last year with perfect success; some of the fruit being kept for nearly six months in good condition. Not a lemon was shipped under ice, and no allowance was allowed nor claim made for decay, excepting on one car, which contained weak stock, and which by reason of a mistake in transportation was nearly a month in transit. In this case 5 per cent. deduction was allowed. There were some weeks ago about sixty-five cars of lemons in the Company's packing-house, and we did not feel the least uneasiness regarding it, knowing that by this method we are masters of the situation. Anyone trying to handle that quantity of fruit by the old method would be gray-headed in a single season."

In conclusion, I would recommend our growers to experiment for themselves with a little fruit, if they have anything like a proper place in which to store it. The dryer the room the better success they will have. Under no consideration use a damp or underground room. Be sure and gather the fruit carefully, avoiding any rough handling, so as not to bruise it. Pick the fruit which is intended for long keeping in May and June (not later), just as it is beginning to show signs of ripening. It will be necessary to look over the tree once every fortnight, in order to get the fruit in its best condition.

Fruit which ripens in the summer or fall will not keep long. The main winter crop is the best for long keeping.—W. J. ALLEN.

AGRICULTURAL SOCIETIES' SHOWS.

1904.

Society.	Secretary.	Date.
New South Wales Sheepbreeders' Association	A. H. Prince	June 29, 30; July 1, 2
Hay P. and A. Association	G. S. Camden	July 21, 22
Riverina P. and A. Association	Wm. Elliott	,, 26, 27
Condobolin P. and A. Association	D. H. Tasker	,, 27, 28
Balranald P. and A. Society	P. Malcolm	,, 28
Narrandera P. and A. Association	J. F. Williams	Aug. 3, 4
Forbes P., A., and H. Association	N. A. Read	,, 3, 4
Parkes P., A., and H. Association	G. A. Seaborne	,, 10, 11, 12
Corowa P., A., and H. Society	E. L. Archer	,, 16, 17
Murrumbidgee P. and A. Association	A. F. D. White	,, 24, 25
Gunnedah P., A., and H. Association	J. H. King	,, 24, 25, 26
Grenfell P. and A. Association	Geo. Cousins	,, 25, 26
Young P., A., and H. Society	C. H. Ellerman	Sept. 6, 7
Junee P., A., and I. Association	T. C. Humphrys	,, 7, 8
Northern Agricultural Association	C. Poppenhagen	,, 7, 8, 9
Temora P., A., H., and I. Association	W. H. Tubman	,, 13, 14
Albury and Border P., A., and H. Society	Walter Johnson	,, 13, 14
Yass P. and A. Association	Will Thomson	,, 15, 16
Wyalong District P., A., H., and I. Association	S. G. Isaacs	,, 21, 22
Cowra P., A., and H. Association	F. P. Faucett	,, 21, 22
Germanton P., A., and H. Society	Jas. S. Stewart	,, 21, 22

1905.

Albion Park A., H., and I. Association	Henry Tryer	Jan. 18, 19
Tenterfield Intercolonial A. and M. Society	F. W. Hoskin	Mar. 7, 8, 9
Fair Days		,, 10, 11
Central New England (Glen Innes) P., A., and M. Society	Geo. A. Priest	,, 14, 15, 16
Quirindi District P., A., and H. Association	Will. Cadell	April 5, 6
Hawkesbury District (Richmond) A. Association	C. S. Guest	May 12, 13, 14

[7 plates.]

Return Date	Return Date